Community Health Cell
Library and Documentation Unit
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PREFACE

The exploratory study described in this report has ended up as something quite different from what it started out to be. Assumptions, hypotheses and objectives have been changed in the course of work, new methods of analysis have had to be devised and a certain amount of new terminology has had to be invented. The central purpose, however, has remained - to examine the nature of development and particularly the interrelations of its social and economic aspects thrcugh a comparative (cross-national) analysis using social and economic indicators available as of 1960.

In the execution of this project, data as available on a set of 73 developmental variables for 115 countries with populations over 1,000,000 were incorporated in a Data Bank. These variables were eventually reduced to 18 core indicators whose interrelationships were then intensively studied by a system of "correspondence analysis". The 18 core indicators were subsequently combined into a general index of socio-economic development.

An over-riding problem has been the incompleteness and weakness of the basic quantitative data, and much of the study may be more relevant in suggesting a methodology of analysis than in showing definitive results today. There are also severe limitations on the conclusions that can be drawn from cross-national developmental data that cover social as well as economic factors. Such data cannot, for example, be readily fitted into a deterministic mould or input-output model; or, more precisely, they can be fitted into countless deterministic moulds and so confirm no one of them.

The consequent limitations of this study are apparent. But in the field of socio-economic development where so little is really known, it is necessary to take advantage of each possible source of information. At this Institute, research on socio-economic development is carried out not only through cross-national quantitative analysis but also through country case studies, regional (sub-national) studies, local (community) studies, and other means, quantitative and qualitative, each intended to supplement the others.

The present study is an Institute staff study. Various staff members, in addition to those named, have contributed to it. Two of the main contributors, N.V. Sovani and M. Subramanian, are no longer with the Institute and have not been present for the final drafting.

In carrying out this project we have had the great advantage of close working relations with statistical and substantive offices of the United Nations and the specialized agencies (especially ILO, FAO, UNESCO and WHO). Estimates and evaluations of data have been put at our disposal. We have also made our own estimates and evaluations, however, and must assume responsibility for errors in this report.

D. V. McGranahan

Director

Chapter I

INTRODUCTION : GENERAL AND THEORETICAL CONSIDERATIONS

This is an exploratory study of ways of analysing and measuring development in its combined economic and social aspects. As a quantitative enquiry, it is subject to the limitations of available statistics, which call for discriminate use of the data available, constant awareness of what is not available, and caution in the interpretation of results. It has also to face the fact that there is today no clear and agreed-on definition of socio-economic development - despite its importance as a goal of current international and national policy - and no simple objective criterion of it against which to validate measurement devices. As a result it is necessary to rely on indirect methods and successive approximations in pursuing a quantitative definition of socio-economic development.

Certain assumptions which underlie the present study, and which may differ from commonly held assumptions, are listed briefly at this point:

1. We assume that the national accounts system, including the per capita national income (per capita gross national product or gross domestic product), is not adequate to the analysis and measurement of socio-economic development as a whole. In spite of the nearly universal agreement today that development involves more than economic growth, the per capita index, designed to measure economic growth, is still the only general indicator of development in common use. If social factors, particularly levels of living, are to be considered part of the objectives of development, then another approach to measurement is required which will take account of a country's real health level, its real education level, etc. and not only of the amount of money technically classified as spent on those objectives.

2. We assume that the process of development, involving both economic and social variables, is not a uniform linear progression of a set of variables but rather a changing complex of factors which move at different rates in relation to each other and move in and out of importance at different levels of development and in different types of country. Thus, what constitutes an important advance in a component of development in one country will not necessarily constitute an advance of the same significance in another country.

3. We assume that [illegible] in statistical techniques designed for static populations and "normal distributions" may not be entirely appropriate for the quantitative analysis of developmental data and that special techniques of analysis may be called for in this

type of study. For example, even the most commonly used device of statistical analysis, the statistical "mean" or average - one of the three measures (along with the "median" and the "mode") of "central tendency" - is often not relevant to a wide-ranging array of developmental data where there is no central tendency. (To cite an example from physical development, it is meaningful to ask the average height of the adult male population of a city, or of male children aged precisely 10 months or 10 years, but not very meaningful to ask the average height of all male children aged 0 to 20 years).

4. We assume that developmental data, whether cross-national (data on different countries at the same time) or cross-temporal (data on the same countries over time), do not as a rule justify the use of correlation analysis or regression analysis to determine directions and amounts of causal influence or functional dependency in the development process - the specific influence of A on B or of B on A or of C on A and B. Development involves a great many variables that correlate with each other, and the fact that one variable in a set of developmental data can be treated statistically as an "independent" variable and another as "dependent" does not demonstrate the existence of such dependence in reality, nor reveal the amount of dependence (or causal influence) in one direction where dependence can be reasonably assumed to exist.

For most of the developing countries, quantitative data relevant to this study were little produced before 1950 and became available to a fair extent only around 1960.[1/] Time horizons of the study are therefore necessarily restricted and reliance is placed largely on cross-national analysis, in particular on the comparative analysis of countries at different levels of development as of 1960. It cannot be assumed that generalizations based on cross-national data will apply cross-temporally; that differences between more developed and less developed countries at a moment of time will necessarily define paths of development in the future. For example, if (as is true) small differentials in income are in general associated in cross-national data with large differentials in health at the lower levels of development while large differentials in income are associated with small differentials in health at the higher levels, it does not necessarily follow that individual less-developed countries experiencing a relatively small increase of income over a given period of time will as

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1/ Partly as a result of the action of the United Nations Statistical Office, and the statistical offices of the specialized agencies, in getting standardized items introduced into the 1960 round of censuses.

a rule have a large increase of health around the same time, while large increases of income over time in highly industrialized countries will as a rule have relatively little associated health improvement. Such a conclusion is not a logical necessity. It is, however, a probability (and in this example is quite valid).

Predictions about cross-temporal development based on cross-national analysis will be limited by a number of factors: by the effect of innovations, unusual events (epidemics, droughts, etc.), new policies widely adopted (e.g., sudden increase in emphasis on education in the low-income countries), and by persistent idiosyncratic or typological characteristics (geography, population size, climate, etc.) which may distinguish countries at a given level from those above it.

If there are limitations on cross-national analysis, however, there are also limitations on cross-temporal analysis as a basis of generalizations about the course of development. If, as stated above, development is not a uniform linear progression but is characterized by changing patterns of relationship among factors, then a country's own past trends may not predict its future very well. Furthermore, the historical experiences of countries now called "developed" have limited relevance to the developing countries today. It cannot be concluded that the latter countries will or should repeat the historical development paths of the former - modern science and technology have made this quite unnecessary. The most revealing kind of cross-temporal analysis would cover modern periods and involve a large sample of countries, developing as well as developed. But, as noted above, the statistical basis for quantitative studies of this kind hardly exists, except for a limited number of countries and a limited number of variables between 1950 and 1960 or 1965.

The Per Capita National Income as a General Measure of Development

The quantification, in recent decades, of the national income or national product (and its derivative, the per capita national income), is an intellectually bold innovation which has had a far-reaching influence on development planning - the basic target of economic planning is often formulated as a given rate of increase of per capita income - and which has been used widely by both national and international agencies in reports and analyses. As a general measure of development, however, covering social as well as economic aspects, it has certain inherent weaknesses. An international committee of experts on levels of living, after considering the matter in some detail, made specific recommendations against the use of the per capita national

income as a measure of levels of living,[1/] and this position has been generally endorsed in subsequent discussions by United Nations expert bodies. It should also be noted that, quite apart from theoretical considerations, when the per capita national income is used in practice as a means of ranking countries according to their general levels of development, the ranking obtained sometimes conflicts sharply with a common sense ranking.[2/] In fact, the classification of countries into "developed" and "developing" used in practice does not coincide with a breakdown according to per capita national income.

There are three major limitations on the per capita national income which are inherent in its very nature:

1. As an aggregative concept, it does not reflect structure and distribution. If it is used as a general measure, then different countries are equally developed, if they have the same per capita income, whatever the contents of their development. Yet, some countries can have a well-balanced economic development covering both agriculture and industry, and a relatively healthy and well-fed population, while others, with the same per capita income, can be developed in only one limited part of the economy (e.g., mineral resources) and the mass of the population, relatively untouched, may continue to live in traditional poverty.

2. As a monetary concept, the per capita national income does not take account of values that lie outside the monetary sphere, nor of social values or "real" values of things that may differ from their prices (e.g., the real value of penicillin, in combating disease, compared with previous drugs costing the same

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1/ See United Nations "Report on International Definition and Measurement of Standards and Levels of Living" (E/CN.3/3/179, E/CN.5/299), 1954.

2/ It is difficult to conceive, for example, that Japan, which had a per capita income of $439 in 1960, but also extensive industrialization, universal literacy, and levels of health and school enrolment equal to those of European countries, should be classified on a developmental scale at a substantially lower point than, say, Venezuela, which had a per capita income somewhere between $650 and $1100 (according to different sources of estimate) but in other respects was much less advanced than Japan. Venezuela in 1960 still had a third of its population illiterate, its infant mortality rate was nearly twice as high as Japan's, and its higher education enrolment ratio was half that of Japan.

for the same diseases; the real value of goods or services that benefit the user but pollute the environment to the detriment of society in general). Market prices, in so far as they depend on effective demand, reflect the income distribution of a country, not a popular vote on what is important. At the same time, many countries today try to keep the prices of marketed goods and services meeting basic social needs (e.g., food, rents, transport) artificially low, in comparison with what the free market would yield.

3. As a market-based concept, the national income does not apply readily to centrally planned socialist economies, subsistence economics, or non-market sectors of predominantly or partly market economies. In the case of the centrally planned economies, which compute a "material product", conversions to the national income concept have been attempted but they are difficult and uncertain. In the case of subsistence economies (which play a large role in developing countries), "imputations" are made for non-marketed goods and services, but these raise perplexing questions - such as the question whether subsistence families producing and consuming exactly the same goods and services should have widely different incomes imputed to them simply because they live in different areas with different prices at the nearest markets. Many goods and (especially) services in subsistence societies are left out of the imputations, including most equivalents of the social services. Even the advanced market economies today have important subsistence sectors without imputed values, e.g., the work of housewives. In general, publicly provided services, in education, health, recreation, social security, banking, etc. are valued at cost in computations of the national income, but the costs may be much less than free market prices would be - or they may be much more (because of over-swollen bureaucracies, inefficiency and corruption). In either case - and this is a problem particularly relevant to the social sectors - the level of public expenditures (costs) can be a poor indicator of the actual levels of consumption and welfare among the population at large; changes in costs (upward changes due to increased inefficiency, or downward changes due to increased efficiency) may occur without any change in social welfare.

Other difficulties that affect the use of the per capita national income as an international measure of development arise from technical problems of pricing the product in an inflating market; problems of comparing countries (or parts or time

periods of the same country) that have different patterns of consumption and valuation; and problems of converting the income of the different countries into a single international monetary scale.[1/] These difficulties are well-known among the professional personnel working on national income statistics and are dealt with in one way or another, according to the best judgments that can be made. Finally, there is the major problem of lack of data on per capita national income figures in many countries, and frequent use of incomplete or unreliable data in the construction of per capita national income figures.[2/]

The Measurements of Levels of Living

A quite different approach to measurement has been taken in the case of social aspects of development, in particular levels of living. Here the procedure has been to select the basic structural elements or "components" of the level of living, and then seek the most suitable statistical indicators of these components.[3/] In some cases it

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1/ Such technical problems appear to be the main reason why estimates by different authorities of the per capita income (in dollar equivalents) of the same country for the same year may vary widely. For example, for several countries of Latin America around 1960 there are five or six different estimates coming from different international, regional and national authorities. Some of these estimates differ from each other by as much as 100% to 200%. Other indices computed internationally, such as per capita calorie consumption, also vary according to the source of computation, but none vary nearly as much as the per capita national income.

2/ Preparation of national income figures, especially in developing countries with inadequate basic statistics, may involve numerous estimates or guesses. While the per capita national income is supposed to be constructed by dividing the net national product by the total population, in practice the procedure may be the reverse - an estimate of average (per capita) production may be made and this may be multiplied by the estimated national population figure to get the national product (when the population figure proves too low, as has happened, there is not a readjustment of the per capita income downward but of the national product upwards).

3/ The twelve components recommended by the above-mentioned committee of experts on levels of living were as follows:

1. Health, including demographic conditions
2. Food and nutrition
3. Education, including literacy and skills
4. Condition of work
5. Employment situation
6. Aggregate consumption and savings
7. Transportation
8. Housing, including household facilities
9. Clothing
10. Recreation and entertainment
11. Social security
12. Human freedoms

A subsequent inter-agency working party proposed certain revisions, mainly the elimination of transportation and aggregate consumption and savings. (See United Nations, "International Definition and Measurement of Levels of Living; An Interim Guide", E/CN.3/270/Rev.1, E/CN.5/353).

is not possible to find suitable indicators for international usage (e.g., in clothing, recreation, social security, human freedoms), although there may be indicators available within individual countries. The failure to find internationally comparable indicators may be due to differences in need (clothing), in tastes (recreation), or in administrative systems (social security); or to the fact that some aspects of living (human freedom) have yet to be quantified in any very meaningful way.

The component-indicator approach can be extended so as to cover economic components and indicators as well as social ones. But as a means of general measurement of development, it too suffers from certain inherent weaknesses.

1. It gives a picture of the parts but not of the whole. If a single over-all index of development is possible, then it is desirable to establish it, for a number of practical reasons. If nothing better can be found, the per capita national income will continue to be used for the purpose.
2. Even the picture that is given of the parts is of limited value, from a policy point of view. To know a country's life expectation or school enrolment rate, for example, will be a means of comparing the country's health or education levels with those of other countries, or those of the same country some years forward or back. But it will still not reveal whether the indicated health level or education level is high or low for this country - a fact of great importance to policy-makers. For such a purpose it is necessary to have some measure of the relation between the level of a particular indicator and the levels of other indicators for the same country.

The Main Tasks of the Present Study

In this study we have attempted to carry out three main tasks:

1. To select the best available indicators of social and economic development;
2. To establish the relationships among these indicators at different levels of development;
3. To combine them into a synthetic indicator of development.

The Selection of Indicators

In the selection of indicators, the first question is whether development is to be understood in a more evaluative, subjective sense or in a more empirical, objective sense. On the one hand, it can be viewed as a process of realizing certain goals or values (improved health, improved housing, better nutrition, more communications, improved transportation, greater use of electricity, etc.), and from these the

quantitative indicators can be derived theoretically. On the other hand, countries that are more developed and those that are less-developed can in principle be studied and compared, and the empirically found differences between them can be used as a basis for choosing indicators of development. It will no doubt be found that the more developed countries generally have higher scores than do the less developed countries in the value categories selected by the first approach - better health, better housing, better nutrition, etc. - but the two approaches do not necessarily lead to the same results (as indicated in the discussion below on industrial pollution and urban crime) and each of them has its limitations.

In the first, more subjective approach, it is easy to load the concept of development with variables that may be arbitrary, capricious or contradictory. Also, variables that are conceived in an a priori fashion to be good indicators of development can prove in practice to be poor indicators, for reasons of technical deficiency (examples will be given below). Finally, a purely valuative approach will omit consideration of important structural aspects of growth which are not necessarily values in themselves.

If we rely wholly upon an empirical approach, however, other difficulties arise. The characteristics that distinguish more developed from less developed countries (or that change in the course of growth of individual countries) are often trivial or undesirable. For example, since developed countries have been generally of the European culture stock, certain tastes and habits (styles of clothing, kinds of food and drink, forms of recreation, family customs, etc.) will be found quite widespread in developed countries and not in developing countries, but these will have little or nothing to do with the basic process of development. Also, in more developed countries there will be found in greater degree certain negative features such as industrial pollution, noise, urban crime and other undesirable concomitants. In a purely empirical sense these are part of "development". It is obvious, however, that when governments pursue development

or contribute to international development programmes, they do not intend in their concept of development to include an increase of pollution or urban crime rates, and it would be paradoxical to include these as measures of development.[1/]

In this study, we have used a combined approach. We have understood development on the one hand, to involve progression towards various objectives or values which countries seek to achieve - or, more precisely, regarding which countries seek to improve their position, since in most cases there is no final achievement but movement along a continuum (of ever higher income, ever more education, ever better health, etc.). The objectives or values of development, as defined in this study, are limited to those that are internationally agreed upon. They are thus understood to be common objectives or values. It is not too difficult to determine such values. They are stated in international documents, and are reflected in the structures and activities of international organizations established to assist countries in their development. When the majority of countries of the world agree to set up and finance an international activity to promote, say, health, education or industry within countries, this serves to identify internationally agreed upon components of development.

1/ In fact, the very opposite conditions, namely freedom from industrial pollution or absence of urban crime, may be considered among the values that define development in a subjective sense. The presence of considerable industrial pollution or extensive urban crime would indicate a low level of development. This is a tenable semantic position. If all the values of this kind in which developing countries are as high as developed countries (or higher) are included in the concept of development, however, then it will be necessary to invent a new expression to cover those factors that tend to go together and distinguish more developed from less developed countries. The issue does not actually arise in this study because factors like industrial pollution or urban crime which may be associated positively with development in an empirical sense but negatively in a conceptual sense do not have satisfactory enough cross-national statistical coverage to be considered in the research. In principle, however, we prefer to conceive of such factors as potential concomitants or consequences of development which should be dealt with by planning but which should not be considered part of development strictly defined. There are other desiderata of human society concerned with the character and quality of human relations which may be considered elements or goals of "progress" broadly defined but not of development as here conceived. As long as expressions like "more developed" and "less developed" countries, or "developed" and "developing" countries, are used, it seems inappropriate to include these various aspects in the concept of development and thereby imply that the developing countries are normally more deficient in regard to them than developed countries are.

At the same time, we have also used an empirical approach, in that indicators for the components as defined above have been sought which empirically distinguish more-developed from less-developed countries up and down the scale. Conversely, indicators that empirically distinguish more developed from less developed countries have not been used if they do not reflect agreed-on international values; nor have indicators been used which may appear to reflect international values but do not distinguish empirically between countries having different levels of development.

There is one important qualification to these statements. Various changes take place with the process of development that are not necessarily - and not generally or universally - considered to be the real goals of development. Such changes may include, for example, changes in the structure of employment, or in the demographic structure. Where such changes can be judged to be important structural aspects of development (although not ends in themselves) and where indicators of them are found to be consistently associated with other aspects of development, they have been considered to be part of development.[1/]

Theoretical considerations in the selection of Indicators

It may be noted that the discussion to this point involves a certain circularity. We have assumed that variables shown to be empirically correlated with development (distinguishing between the relatively more developed and the relatively less developed countries along the scale) are to be considered part of the measurement of development, if they fall under one of the value components or one of the structural components. This implies the prior existence of a quantitative criterion of development (to line up countries by degree of development) with which these variables can be correlated, as a basis of their selection. But no satisfactory prior-existing quantitative criterion of development is to be found. We are faced therefore with a major methodological problem - how to select indicators of socio-economic development empirically in the absence of an objective criterion against which to test or validate them?[2/]

1/ Their incorporation in the study provides a structural emphasis additional to that provided by the analysis of the interrelationships of the component-indicators.

2/ In social and psychological measurement, validation is often relatively simple - a test of safe driving ability can be validated against insurance records of accidents, or a test of college aptitude against college performance. In the case of the well-known IQ test, a determination is made whether certain items consistently discriminate between levels of intellectual skill by seeing if older (intellectually more mature) children do better on them than younger children (the IQ score is then the age level of a child's mental performance divided by his chronological age).

While it is possible on intuitive or common-sense grounds to divide countries roughly into "developed" and"underdeveloped" - perhaps leaving out hard-to-classify middle-level countries - there is no adequate means of ranking countries within these two categories, in terms of their over-all socio-economic development. It does not necessarily follow that variables that discriminate between two extreme categories of developed and underdeveloped countries will satisfactorily discriminate between countries within the two categories (we have found that birth rate is such a case).

This problem has been dealt with in two ways in the study. First we have employed a method of successive approximations. Second, we have made the assumption that variables with high intercorrelations on the average with other (conceptually derived) development variables are better indicators than those with low intercorrelations - the mass of other variables is used in effect as a criterion against which to test any given variable. This is roughly equivalent to selecting indicators that best distinguish between countries along the scale of development as these countries are defined in the first approximation by their average (unweighted) scores on all the conceptually derived variables.[1/] As a set of indicators is selected by this process, it serves in turn as a criterion against which to test and select (on the basis of average correlations) a further more refined set. An initial group of 73 indicators covering the different economic and social sectors was reduced by this method first to a group of 42, and finally to a "high-correlate core" of 18 indicators. Certain other considerations besides simple correlation were involved in the selection process, particularly avoidance of duplication (different indicators measuring much the same thing and highly correlated for that reason), ensurance of statistical significance of the correlations in terms of the number of countries having data, and, where equally qualified indicators were available, preference to those giving a wider sectoral spread.

1/ More precisely stated, in a group of conceptually derived indicators where in general a fair degree of correlation is found (as in this study), the highly correlated indicators, as compared with any other selection of at least the same number of indicators, are those which would in principle individually correlate best with (and best predict) the order of countries given by country scores averaging ranks on all conceptually derived variables (including the ones to be rejected); and which would correlate particularly highly with an order of countries obtained by use of the averages of the ranks on the high correlate indicators themselves. Conversely, the low-correlate (rejected) indicators as a group are those which would correlate least well with an order of countries given by average country ranks on all conceptually derived variables, and which would not correlate well even with that order given by use of the group of low-correlate indicators themselves to obtain average country scores.

The selection procedure just outlined implies that development, in so far as it has international meaning, can be defined quantitatively by a group of highly intercorrelated, conceptually significant variables, which tend to undergo changes together (although not necessarily at the same rate). The fact is that such variables can be found. But the question may be asked: Why do the components of development need to be intercorrelated? In the construction of psychological tests, for example, measures may be chosen that have relatively low correlation with each other but high correlation with the objective "criterion".[1/]

The answer to the question lies in the nature of the developmental data and the developmental problem. The factors or aspects whose change constitutes development must necessarily be correlated with each other in a developmental data array. The first reason for this is theoretical: development is to a large extent by its nature a system of interdependent variables. The second reason is logical or methodological: if development is what distinguishes more developed from less developed countries (up and down the scale), and if the indicators relate to features of development that are common, then these indicators must be correlated (quite apart from direct causal influences between them), unless there is a strong central tendency yielding a bell-shaped curve of distribution of countries along the dimension of development - which there obviously is not.[2/] Under these provisos, higher scores will tend to be found together in the mostly highly developed countries, lower scores together in the least

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1/ For example, one can imagine a test of safe driving ability which includes (1) a measure of speed of reflex action and (2) a measure of degree of caution, both of which are separately correlated with objective evidence of good driving (lack of accidents) but which are not correlated or are even negatively correlated with each other in the population at large (because, let us say, young people tend to have quick reflexes and little caution while old people tend to have slow reflexes and much caution and these combinations exist in large numbers, filling out the central area of a bell-shaped curve of safe-driving ability).

2/ The same is true of development data in any field. For example, if two factors such as increase of physical size and increase of vocabulary size are normal measures of child development, then they must necessarily correlate with each other in a population of school children that is more or less evenly distributed over the age-groups - even though there may be no direct causal relation between these attributes and no correlation in the adult population or within a given age-group. Each child each year increases in both attributes; older children as a rule are superior in both attributes to younger children. This defines correlation of the attributes. The more that the attributes are associated purely with maturation, the higher the correlation.

developed, and medium scores in between, thereby establishing correlation. This is not to deny that in addition to common factors of development there are also particularistic factors - ways in which individual countries pursue their individual geniuses - which would not correlate. The present study, however, is concerned with the general features of development.

Conversely, if an indicator does not have a good correlation with the other indicators of development, then it must be rejected as a development indicator. Two illustrations of such rejection may be taken from the findings of this study.

Transportation can be considered on conceptual grounds to be a component of development. Yet if we take, as an indicator of transportation, railway passenger miles per inhabitant, or per inhabitant per square kilometer, or other railway measure(freight tonnage per inhabitant, or per inhabitant per square kilometer, etc.), we find relatively low correlation with other indicators, both economic and social. Countries that are higher than others on railway usage are not very consistently higher on indicators of industrial production, agricultural production, education, health, communications, etc. This is apparently due to the fact that there are alternative modes of transportation today (motor-cars and trucks, trams, waterways, airplanes) and no single good overall measure. In many countries railways are losing ground to other modes of transportation. Motor cars per thousand inhabitants has a better general correlation with other indicators than does railway usage but still not very high, because it too is a partial indicator and also apparently because it reflects to a considerable extent skewed income distribution - there are various developing countries where a relatively large number of motor vehicles can be found together with low national levels on other indicators, because the possession of the motor vehicles reflects wealth in an upper-class stratum of a society that in the mass is poor and underdeveloped.

The second example is simpler. Health is a value component of development and crude mortality rate may be proposed as an indicator of health. But it has a relatively poor correlation with the mass of other indicators. The reason here is well-known: crude mortality rates take no account of age structure of the population, and as a result a less developed country with a relatively young population may have as low a mortality rate as a more developed country with better health but with a low fertility rate and a relatively high proportion of aged people. (Life expectation, on the other hand, has a high correlation with other indicators and is used in this study).

It should be noted that indicators rejected for low correlation on a cross-national basis may serve as satisfactory indicators within a given country. Thus, railway mileage or crude mortality rate may be valid within a single country - but only so far as changes are not taking place in the structure of transportation or in the population structure which will invalidate these indicators for cross-temporal comparisons also.

In general, the selection of indicators by the method used in this study appears to make sense in terms of results. (This is perhaps the best justification for the method). The indicators that survive the process of selection generally appear reasonable; the eliminations do not appear unreasonable. In fact, there is a significant finding in this regard that was not wholly anticipated: by and large, indicators that are judged technically superior by experts in the sector or component concerned have high correlations with technically superior indicators in other sectors, often higher in fact than with technically inferior indicators within the same sector. Thus, life expectation correlates better with selected educational, agricultural and industrial indicators than it does with inferior health indicators, such as inhabitants per physician or per hospital bed. The net result is that the use of average correlation as a basis of selection does not eliminate sectors for which there are relatively good indicators but permits a fairly wide sectoral spread.

It may be proposed that highly correlated indicators are redundant; that we should keep one or two and give up the others because the results are much the same. This, we believe, is a mistaken approach. It is precisely in individual deviations from the usual correlations that the most interesting information for quantitative development analysis and diagnosis may often be found. Furthermore, one cannot seriously propose to measure agricultural production by school enrolment or newspaper readership, for example, in spite of high correlations.

Data Deficiencies and their Implications

The main problem of coverage or exclusion of different components, sectors or aspects of socio-economic development lies in the deficiency of the basic data. Factors that cannot be measured at the present time - for lack of even a technique of measurement, or lack of data (too few countries having the relevant statistics), or lack of comparability of data - must necessarily be excluded from consideration in the set of indicators.[1/] Among subjects for which satisfactory comparative international

1/ We have deliberately excluded countries with a population of less than 1,000,000 from the study because of the special circumstances that apply to so many of them.

measurement for one reason or another is not yet possible in a study of this kind are: employment and underemployment, working conditions, social security, mobility, income distribution, land tenure system, human freedoms, and various political, administrative and psychological factors like popular involvement, motivation and efficiency. The omission of these factors has nothing to do with their importance or centrality in development - it is simply that data on them are not internationally available to meet the requirements of the present study. The quantitative approach to socio-economic development is necessarily incomplete.1/

A special note regarding the omission of data on income distribution is called for. There are only very few countries - mostly developed countries - that have relevant and comparable data on this subject, and even here the validity or reliability of the data may be disputed. But income distribution in its broader sense means distribution of levels of living, and the data situation in this regard is not as bad as it is for the strict meaning. A number of the indicators available do reflect to some extent distribution of levels of living. Percentage of children in school, literacy rate, percentage of dwellings with electricity, even life expection rate (which is highly influenced by infant survival) are essentially measures of spread of a socially favourable condition in a society and can be contrasted with indicators of a per capita type where a given increase may simply reflect the piling up of more benefits where benefits are already piled up. The United Nations 1961 Report on the World Social Situation pointed out that countries relatively high on the per capita national income and per capita energy consumption indicators but low on infant survival rates (inverse of infant mortality rates) and school enrolment ratios, were countries that could be characterized as having considerable inequality or maldistribution of income.2/

1/ This does not mean, however, that there is nothing to be learned from the quantitative data that are available, and that quantitative enquiries should be abandoned until the ideally desirable data are on hand.

2/ Certain (as yet unpublished) research at UNRISD has shown that a single distributional indicator can be constructed out of the amount of the difference in a country's status on two kinds of indicator: an indicator of "affluence" and an indicator of "basic need". Thus, an indicator reflecting the difference between the number of automobiles per 1000 population and the expectation of life shows a high correlation with the few available and comparable national figures on income distribution: countries with relatively large numbers of automobiles but low levels of health rank consistently lower on the income equality scale than do countries with fewer automobiles and better health.

The quality of the data that are available raises another set of problems. This has required screening of existing statistics, with the help of the competent international offices, but the data that remain are still not wholly satisfactory, whether because of the limited reliability, weaknesses inherent in the nature of the indicators (school enrolment does not necessarily reflect quality of schooling, etc.) or the fact that a particular indicator may play an anomalous role in given countries.

The imperfections remaining in indicators after screening require that a fairly large set of them be used lest the deficiencies or eccentricities of particular ones of them in particular countries affect the analysis. (Other reasons for using a fairly large set of indicators are the need for sectoral coverage and the non-availability of different indicators in different countries - see below.)

If statistics are limited to those data that are judged reliable and this in turn limits the coverage of an indicator essentially to the developed countries, then quite misleading conclusions may be drawn about the nature of development - because of the fact that the significance or the behaviour of particular variables is not necessarily the same for developing countries as for developed countries. To deal with this problem it has been necessary to examine indicators in the context of both developed and developing countries, to include in the general analysis only indicators that cover a minimum number of developing as well as developed countries, and to change weights of various indicators with level of development.

It is characteristic that a given country may have data available on two indicators, but none on a third indicator. Even the highly developed countries will be found to lack data on certain indicators. Most of the developing countries have many gaps - but not the same gaps. This means that any method of analysis or measurement (e.g. multiple correlation or factor analysis) requiring coverage of all selected indicators in all countries figuring in the analysis, would end up with either so few indicators or so few countries as to be practically useless.[1/] A flexible methodology has had to be established, making full use of what information is available.

1/ The problem of missing data can, of course, be dealt with by means of estimates. But estimates that are based on assumed relations between variables can distort the analysis in which they are subsequently used. Thus if by regression techniques we estimate production from trade or trade from production for a number of countries, when one or the other figure is missing, we should not be surprised to discover in subsequent analysis involving these estimates that trade and production show a very high correlation. Estimates of a more subjective type present similar dangers ("halo effect"). We have therefore avoided estimates in this study, except in cases (e.g. estimates of life expectation rates from inter-censal data) where one can be fairly confident that the process of estimation will not by its nature bias the results of the study by confirming the assumptions of the estimates.

A final problem of the basic data is that many indicators do not in their raw form take account of background factors that affect their significance. One such factor of considerable importance is age structure of the population. Adjustment for age structure is built into the life expectation rate, and it is frequently recognized with regard to food consumption - children do not need as many calories as adults, so it is not proper to compare caloric consumption in two populations on a simple per capita basis if the age structures are significantly different (or to compare two different periods in the same country as a measure of progress if the age structure has been changing). But it is usually overlooked that the same consideration applies to practically all indicators of the per capita type: we should not expect children to require the same amount of housing as adults, or of newspapers, telephones, electricity, income, etc. Differences in national income between countries (or between different periods of the same country) can be rendered misleading by the assumption - implicit in the common use of the per capita national income for comparative analysis - that children should produce and consume the same amount of goods and services per annum as adults. In this study we have sought to introduce adjustments for age structure in all relevant indicators.1/

The System of Correspondence among Indicators

The second task of this study, as indicated above, has been to determine the system of relationships among the selected indicators. Two observations made in preceding paragraphs have a particular bearing on this task.

1. From the point of view of policy and planning, the important question is not what level a country has reached in a given component of development but whether that level is high or low for the particular country, at present and in the planned future, given the totality of its current conditions and its projected conditions. This requires a particularistic diagnosis. There can be no universal prescription today to the effect that all developing countries should have the same life expectation or

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1/ We have not, however, in the present report, introduced certain other adjustments which have been suggested by findings, towards the end of the study, on the role of "typological" factors (see below). It appears, for example, that large sparsely populated countries do not have the same needs as small countries in certain respects (e.g., energy consumption per adult equivalent, foreign trade) if levels of development are otherwise to be about the same. The questions of adjustment here are currently being examined.

education level for their ten-year target, or should all increase their health levels or educational levels by the same amount or percentage. The target level for a specific indicator should relate to the country's current developmental status and capacities - revealed in part by its levels on other indicators - and should be consistent with other targets. The consideration and assessment of a particular indicator in relation to the levels of other indicators - for example, consideration of the level of health in relation to income, education, etc. - will be facilitated by the existence of norms of relationship. There are, however, no ideal norms, particularly when it is a matter of relating a social factor like health or general education to an economic factor like income or production. But empirical norms can be established - the relationship that tends to prevail in practice at the different levels of development.

2. From cross-rational correlations or regressions it is not possible to derive directions and amounts of causal influence between variables. From factory production records we can determine the amount of iron required as input to produce a given output of steel; but we can not determine from international statistical comparisons the amount or level of national education or health that is required to produce a given amount of national income. The data show co-variation but do not permit the sorting out of the various influences (of education on income, income on education, of third factors on each, etc.). Even cross-temporal data (such as they are) do not as a rule yield a quantitative determination of dependency relations between variables. The fact that an increase of one variable can be seen in time to follow a known increase of another variable proves little in developmental data, since numerous variables are changing most of the time. There are numerous possibilities of explanation but no proof of particular explanation. We cannot prove that the growth of a child's finger is dependent on the growth of his foot simply because it can be shown that each successive growth of the finger has been preceded in time by a known and measurable growth of the foot.

Instead of attempting, on the basis of correlations, to formulate dependency, input-output or causal relations between the selected developmental variables, we have undertaken a more descriptive analysis of the inter-relations in terms of "correspondences". These are designed to show what level of growth or advance on any particular indicator tends to correspond normally to a given level on any other indicator, and vice versa (so that, knowing the score of a country on the one indicator,

its probable score on the other can be best predicted). Basic to this conception is the requirement of system consistency: if a particular level (x) on one indicator corresponds to a particular level (y) on another indicator, and this corresponds to a level (z) on a third indicator, then the reverse must also be true - level (z) must also correspond to level (x) and level (y).

In graphic terms, this approach means that instead of setting up regression lines expressing dependency of A on B or B on A, we have sought to determine a best-fitting curve in a scatter diagram relating A and B. Since the variables are highly correlated, this is not too difficult for any two of the selected variables (even though there is no final and definitive mathematical determination of what the best-fitting curve should be for a given array of data on a scatter diagram). In the present study we are dealing, however, not with two correlated variables but with 18 intercorrelated variables, and the problem is to find what in principle is the best-fitting curve to a scatter diagram in 18-dimensional space. In practice, this has involved rather laborious step-wise procedures.

The resulting correspondence points, which are set forth diagrammatically in Chart 13, do not necessarily indicate the ideal pattern or profile at the different levels of development, but rather the "normal" pattern against which a country can compare itself. The correspondence system also shows how different variables tend to change at different rates at different levels of development. The correspondence analysis is important for the procedures followed in further analytic steps in the study, including the procedures followed in the construction of a general index of development.

The Construction of a General Index

The construction of a general index of socio-economic development, which can hopefully serve better than the per capita national income for certain purposes of analysis and planning, has been the third main task of this study. High inter-correlations among a substantial number of indicators covering a wide range of agreed-upon components of development suggest the existence of a "general factor" of socio-economic development, which should be open to measurement.

There are three problems in the construction of a general index: (1) the selection of the constituent indicators; (2) their transformation or conversion to a common scale; and (3) their weighting prior to merger.

The first of these problems is dealt with in the selection of the "high correlate core" of development indicators, mentioned above.

The second problem is the most difficult and complicated, from a technical point of view. The procedures followed in dealing with it have major consequences for the resulting index; indirect effects of these procedures on weighting can be more important than the direct effects of deliberate weighting.

The basic question in conversion of indicators to a common scale is how to determine equivalences - to decide what score on each given indicator (of health, education, agricultural production, etc.) is to be converted to 0, what score to 10, 25, 50, 100 or any other point on the new scale. In this study the correspondence points system was used as the means of determining equivalences for the purpose of conversion to a common scale. Thus, 0 points were defined as the lowest set of correspondence points that could be determined with some reliability; 100 points as the highest; and intervening points were defined by intervening sets of correspondence points, with values assigned, after scale transformation, in terms of the number of equal intervals or steps up the transformed scale.

The third problem, that of weighting, was handled more simply. Reasons have been given above for the use of level of correlation with other indicators as a basis for the selection of indicators. The same reasons justify the use of correlation as a basis for weighting the selected indicators when they are merged. Since the indicators selected all had high average correlations, there is not a great deal of difference among them in this regard. As noted above, however, the degree of correlation of a given indicator with other indicators changes at different levels of development. A system of shifting weights (varying with the level of development) was therefore devised and used in the final step. This gave slightly more variation in the weights of different indicators than did the use of the overall correlation values.

The general index that has emerged from the above procedures (see Table 12) yields a ranking of countries that appears to make more sense in particular cases than does the per capita national income.

In many respects, however, any general or synthetic index obscures more than it reveals. By and large, the representation of a country's profile on a correspondence system chart probably gives more useful information for planning purposes than does its score on a general index.

The general index does, however, serve certain useful purposes. It gives a more substantial picture of what is happening to a country over time than does the per capita national income, which tends to show rather erratic fluctuations from year to year. It provides a better basis for dividing developed from developing countries when such a distinction is required (in terms of overall level of socio-economic development). It is of particular value in the prediction or estimation of missing scores on

indicators for which data are not currently available in given countries. In fact, because the general index correlates more highly with individual economic as well as social indicators than does the per capita national income, it predicts missing economic as well as social scores better than does the per capita national income.

The General Index and Typologies of Development

A final use of the general index is in connexion with what are called in this study "typological differences". By this expression is meant differences between countries in terms of conditions which are not themselves components of development, but which may influence the manner of development. They include geographical size, population size, population density, culture area, climate. It cannot be assumed that different types of country (i.e. different with regard to such attributes) will normally develop in the same way. We have indicated above that the components of development considered in this study are common components - that the values are values for all countries (though changing in importance at different levels) and that the structural changes are changes that all countries tend to go through. This position needs some qualification as far as the patterns of development are concerned - different types of country may have different patterns.

Use of the general index - and the methodology of scale transformation associated with it - permits study of a given type of country (large, small, sparsely populated, densely populated, etc.) at all levels of development in order to see if there is any consistent characteristic in the pattern or profile of indicators distinguishing this type from other types of country. The analysis is done by comparing the general index scores of countries belonging to a given type with the (transformed) scores of the different indicators for the same countries. Such an analysis does in fact reveal important differences associated with typological categories. Research is continuing on this subject.

Fast-growing and slow-growing countries

Research is also under way on a similar question concerned with the characteristics of countries that grow fast and the characteristics of those that grow slowly (growth as measured by national income and, in a few cases where data permit, by the general index). The question is whether fast-growing countries constitute a certain type and have a consistent pattern of indicators, as distinguished from slow-growing countries - or whether a country's typology and its pattern or profile have nothing to do with its rate of present or future growth. This is proving to be an elusive problem, however, because consistent fast growth of national income is infrequent - countries may grow fast for a while but then usually slow down for a period - and because most of those countries that do grow fast consistently over a substantial period of time appear to do so for some quite special reason.

Chapter II

INDICATORS OF DEVELOPMENT

Quantitative cross-national studies of development carried out so far have relied on a wide variety of indicators. Almost every one of the existing statistics that could conceivably be used has been used in one study or another. Collections of potentially relevant statistics are to be found in the regular United Nations Statistical and Demographic Yearbooks and the regular statistical publications of ILO, FAO, WHO and UNESCO, as well as in several special compilations.[1/] Some of the latter contain not only basic indicators but also composite, derived, and synthetic ones. Unfortunately, abundance of data is misleading, since what is available is often not relevant, and what is relevant is often not available. Moreover, published data have to be carefully screened to eliminate incomplete, unrepresentative or manifestly inaccurate returns and to ensure as far as possible that the indicators are constructed the same way and mean the same thing for different countries. (These are aspirations that cannot be fully realized).

As a first step in the quantitative analysis of development in this study, a Data Bank was established at the Institute covering a broad range of components of development and incorporating data that passed certain preliminary screening tests.[2/]

On the social side, the components covered were health, nutrition, education, housing, communications; on the economic side, transport and services, agriculture, industry, trade, and "general" economic aspects. These are components or categories of development which international bodies have been set up to promote. (WHO promotes health, FAO agriculture, UNIDO industry, UNESCO education, UNCTAD trade, and so on). Growth or advances in these components can be said to reflect important objectives of development in most countries around the world and the relevant indicators have thus a normative or value basis.

1/ See, for example:

B.M. Russet, H.R. Alker, Jr., K.W. Deutsch and H.D. Lasswell World Handbook of Political and Social Indicators, New Haven, Yale University Press, 1964.

Arthur S. Banks and Robert B. Textor A Cross-Polity Survey, Cambridge (Mass.), M.I.T. Press, 1963.

Norton Ginsburg. Atlas of Economic Development, Chicago, The University of Chicago Press, 1961.

Compendium of Social Statistics, 1963, United Nations, New York, (ST/STAT/SER.K2), and Compendium of Social Statistics, 1967, United Nations, New York, (ST/STAT/SER.K3).

2/ See Compilation of Indicators, UNRISD, Geneva, 1969. Recently 1950 data have been included in the Data Bank for the same countries, although the coverage is much more limited than in 1960.

In addition, a number of structural indicators were included in the Data Bank. The line between developmental and structural indicators is admittedly fuzzy, since a structural change - e.g., change of rural-urban structure, population structure, labour force structure, structure of production - can easily become a value objective. Countries can decide to set as deliberate goals of development a greater degree of urbanization (or a slow-down of urbanization), lower fertility and lower dependency ratio in the population, higher fertility, redistribution of production and of the labour force in favour of industry as against agriculture or vice versa. Structural indicators, like many social indicators but unlike economic production indicators, generally appear in the form of percentages: percentage of the population living in cities of a given size, percentage of the labour force in industry or agriculture, percentage of GDP in manufacturing, etc.

The fact that various political, cultural, institutional and psychological indicators have not been included in this study calls for explanation - several ingenious attempts have been made recently to establish quantitative indicators of such things as the degree of social tension, ethnic homogeneity, modernization of outlook, achievement motivation, political stability, administrative efficiency, national unity, etc. Some of these indicators represent factors that may have a bearing on socio-economic development as determinants but cannot be considered internationally to be parts of it. In others, cross-national comparability does not seem ensured. Many of these indicators are based on subjective evaluations of countries rather than on objective criteria,[1/] and for that reason have not been considered suitable for this study. The subjective evaluations are (almost unavoidably) made from a single national perspective and they involve certain methodological problems which are difficult to control and which could distort the

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1/ A number of social and political indicators, involving in varying degrees subjective evaluations of countries by "experts", have been devised and used, for example, by Irma Adelman and Cynthia Taft Morris, in Society, Politics, and Economic Development, A Quantitative Approach, Johns Hopkins Press, Baltimore (Md.), 1967 (p.13). A. Banks and R. Textor, in A Cross Polity Survey, op cit., present indicators such as the degree of competitiveness of political parties, the degree of cultural homogeneity, etc., which are based on the judgements of the authors.

results of the study, including the ubiquitous problem of the "halo effect".[1] Because it leads to false correlations, this common source of error in subjective ratings has to be particularly avoided in a study based largely on correlations.

In the selection of indicators for this study, advantage was taken of previous international enquiries. For the social indicators, the recommendations made by two United Nations reports in particular were used, namely:

1. Report on International Definition and Measurement of Standards and Levels of Living (E/CN.3/179), 1954.
2. International Definition and Measurement of Levels of Living - An Interim Guide (E/CN.5/353), 1961.[2]

A large number of indicators recommended by these reports were included in the Data Bank. On the economic side, there were no readily available reports like the above, but the discussion of economic development has been extensive and detailed. A few quantitative studies of economic development using a number of economic indicators are also available.[3]

1/ The halo effect is the tendency of judges to rate specific characteristics in terms of general impressions and it results in spurious correlations. For example, a study of ratings of 1100 industrial workers by their supervisors revealed high correlations between diverse traits such as versatility, accuracy, initiative, safety and personality. The ratings showed a marked general factor "apparently corresponding to the foreman's opinion of the man's industriousness and productivity". The tendency of each judge to give the same man similar ratings on dissimilar characteristics contrasted with the fact that two different judges would rate the same individual quite differently on the same trait. Thus, judges who rated workers high (or low) on "safety" tended to rate the same workers high (or low) on "initiative", with a resulting correlation of .54; but the correlation reflecting agreement of pairs of judges as to the same worker on safety was only .35. See Lee J. Cronback, Essentials of Psychological Testing, New York, Harper and Row, 1960, pp. 508-509

2/ The Interim Guide, which will be frequently cited on the following pages, is essentially an up-dated revision, by an inter-agency working party, of the original report (E/CN.3/179), of a meeting of experts at the United Nations in 1953.

3/ Perhaps the most monumental of these are the nine such studies made by Simon Kuznets, Quantitative Aspects of Economic Growth, published as supplements to Economic Development and Cultural Change, during 1954-1968.

The present analysis is confined largely to the year 1960, and countries having a population of less than a million - many of them small islands, principalities or city-states - are excluded on grounds that they call for special analysis. One hundred and fifteen countries are included.

The screening of data for the Data Bank was carried out in several ways. 1) The assistance of the competent international staffs was sought for this purpose (the assistance of the United Nations Population Division for evaluation of demographic data, UNESCO for education data, etc. and the assistance of the UN Statistical Office for the statistics in general). 2) Consistency tests of data on related variables were carried out. For example, a scatter diagram was constructed for expectation of life and infant mortality rates and other related pairs of variables, on the assumption that obvious departures from the general pattern of consistency are suspect and require special examination. 3) The footnotes and qualifications in the statistical publications were carefully examined, and statistics with unrepresentative population coverage, incomplete recording, etc. were excluded. 4) Attempts were made to insure comparability by avoiding indicators that appeared to involve different definitions or meanings in different countries. The reports of expert bodies were particularly useful for this purpose.

As a result of these scrutinies, data as gathered for 1960 for 115 countries in respect of 73 indicators were incorporated in the Data Bank.[1/] A complete list of the indicators included in the Data Bank is given in Table 1. The compilation cited on page 22 gives countries for which data were available in respect of each of the indicators.

The following paragraphs offer brief comments on the indicators included in Table 1.

Health and demographic

The Interim Guide recommends three priority indicators in health:

i. Expectation of life at birth, "considered theoretically the best indicator of health",

ii. Infant mortality rate, "one of the best measures of environmental sanitation closely correlated with the general levels of economic and social development", and

iii. The crude death rate, which through dependent on age structure "reflects" the intensity of mortality in a given country".

1/ This does not count indicators of rates of growth and "typological" indicators (see below). Also a few more indicators were originally included but subsequently dropped because of lack of data or for conceptual reasons.

All three of these indicators - which obviously overlap - have been included in the Data Bank. In addition, three others have been included which have frequently been proposed as indicators of health although questioned by the Interim Guide: death rate due to infectious and parasitic diseases; inhabitants per physician; and inhabitants per hospital bed.

The health and demographic structural indicators include birth rate and gross reproduction rate, dependency ratio, child dependency ratio, and average size of private households, all of which overlap to a greater or lesser extent.[1/] The proportional mortality rate (the ratio of deaths at ages 50 and over to all deaths), which reflects to a considerable extent age structure and which is recommended in the Interim Guide as a "general indicator", has also been included here. The other demographic structural indicators are measures of degree of urbanization (% of population in localities of 20,000 and over and 500,000 and over), plus a measure of urban distribution (the ratio of population in localities of 100,000 and over to population in localities of 20,000 and over). The latter was incorporated on the theory that, with development, urban population becomes more "balanced" in its distribution (a theory that gets little support from the behaviour of this particular indicator).

Nutrition. The four indicators of nutrition are those recommended by the Interim Guide, which, however, notes that none of them is very satisfactory: "no satisfactory and practicable indicators of actual nutritional status of people have yet been developed, although the second and third indicators (concerned with protein and animal protein consumption) have a bearing on it". The level of animal protein is "probably a better indicator than that of total protein in the diet".

Education. The priority indicators recommended by the Interim Guide for education are: adult literacy rate; school enrolment ratio, including combined primary and secondary enrolment and separate primary and secondary school enrolment ratios; and higher education enrolment ratio. To these we have added percentage of the adult population who have completed given levels of education and pupil-teacher ratio, both of which can be considered to reflect quality or effectiveness of education (better than do school enrolment ratios); also female enrolment as a percentage of enrolment in primary education, which may be considered to reflect the status of woman in a society and acceptance of "modern" attitudes.

1/ A certain amount of obvious overlap between indicators has been allowed at this stage in order to have the possibility of choice from among alternatives at a later stage.

Housing. In housing, the main problem has been lack of sufficient data to provide any practicable indicators. The Interim Guide included as priority indicators percentage of population living in "dwellings" (permanent dwellings as distinguished from improvised and semi-permanent huts and shacks) and percentage of occupied dwellings with toilets, as well as percentage of occupied dwellings with piped water and percentage of dwellings with three or more persons per room. For 1960 or thereabouts, however, there is only one country in Africa (Morocco) of a million and more population having data on the percentage of the total population living in "dwellings" and only one country in Asia (Republic of Korea). Similar difficulties exist with regard to percentage of houses with toilet facilities (there are a few developing countries with relevant data on their urban populations only or on their total population for another period). As the best available indicators for 1960, we have used the average number of persons per room and percentage of dwellings with piped water, and have added percentage of dwellings with electricity. The number of countries with comparable data on these indicators, however, is still small.

Communications. Newspaper circulation, number of radios and number of telephones per 1000 population were recommended by the Interim Guide (under "basic information".) We have added television receivers and a combined radio and television index.

Transportation and Services. In the absence of an overall or aggregate developmental measure of transportation in a country, several different indicators of railway usage were included in the Data Bank and an indicator of relative number of motor vehicles. Lack of international data on kilometres of metalled and non-metalled roads precluded use of this as an indicator. Structural indicators of percentage of the labour force in transportation and services have also been included.

Agriculture. The only developmental indicator of agriculture found suitable to incorporate in the Data Bank was agricultural production per male agricultural worker in 1960 US$. Attempts to derive indicators of agricultural production per hectare and of consumption of fertiliser per hectare and per worker did not prove successful. However, it was possible to incorporate, as a structural indicator, adult male labour in agriculture as a percentage of the total male labour. This indicator is restricted to male agricultural workers because of differences between countries in classification of farmwives among agricultural workers.

Industry. The per capita consumption of energy, electricity, and steel are included as general indicators of the level of industrial technology and its use in a country. Percentage of GDP derived from industry has been included as a structural indicator, along with two structural indicators which concern manufacturing only.

Trade. Eight structural indicators as well as two developmental indicators have been included under trade. Several other trade indicators, including balance of payments, were considered but rejected largely on conceptual grounds.

General Economic Indicators. The two major indicators here are per capita GNP in US$ at the official exchange rate and at the purchase power parity rates of conversion (taken from Rosenstein - Rodan). Instead of the per capita GNP in 1960 only, the average for three years, 1959-1961 has been taken in order to avoid temporary fluctuations. Investment per economically active person has been included because increase of such investment is a frequent economic objective and it is considered to be an important factor generating growth. A related structural indicator, savings as per cent of national income, has also been included. The remaining structural indicators of a general economic type have been proposed by one authority or another for use in cross-national or cross-temporal comparisons. Thus the index of "total structural differential in production" has been used extensively by Kuznets in his work on quantitative aspects of economic growth.[1/] It reflects "the deviations of sectoral per worker product from countrywide per worker product, the former weighted by the shares of sectors in total labour force".[2/]

The percentage of salaried and wage earners in the total economically active population is considered an indicator of the degree of modernization of the labour force, and, like other labour force data, an important structural factor in the economic development of the country. Expenditure on food as a percentage of consumption expenditure is widely used as an (inverse) indicator of the real income level of the population. It is recommended by the Interim Guide as a general indicator (not a specific indicator of food consumption and nutrition). Tax revenue as a proportion of GNP was considered but the data were not sufficiently comparable to permit inclusion, owing to the different ways in which budgets are laid out in different countries.

1/ Simon Kuznets, Modern Economic Growth - Rate, Structure and Spread New Haven, Yale University Press, 1966

2/ Ibid, page 416

The list of 73 indicators emerging from these considerations follows in Table 1.

In addition to the above indicators, the Data Bank, for purposes of analytic studies, contains rates of growth of GNP and GDP for various periods between 1950 and 1965, plus population growth 1950 - 1965. Also, the Data Bank contains data on the area of each country, its population in 1960, population density, ratio of agricultural area to total area, and climate. It has proved extremely difficult and perhaps not too meaningful to classify countries in terms of ratio of agricultural area to total area, and even more difficult to classify them in terms of climate. No simple classification of countries in terms of climate in fact exists, for one reason because many of the large countries have several weather zones.

TABLE 1

The 73 indicators included in the Data Bank

DEVELOPMENTAL	STRUCTURAL
SOCIAL AND DEMOGRAPHIC	
HEALTH AND DEMOGRAPHIC	
1. INFANT MORTALITY RATE	7. CRUDE BIRTH RATE
2. EXPECTATION OF LIFE AT BIRTH	8. GROSS REPRODUCTION RATE
3. CRUDE DEATH RATE	9. DEPENDENCY RATIO (CHILDREN AGED UNDER 15 PLUS PERSONS AGED 65 AND OVER AS PER CENT OF AGE GROUP 15-64)
4. DEATH RATE DUE TO INFECTIOUS AND PARASITIC DISEASES, PER 100,000 POPULATION	10. CHILD DEPENDENCY RATIO (CHILDREN AGED UNDER 15 AS PER CENT OF AGE GROUP 15--64)
5. INHABITANTS PER PHYSICIAN (IN 000'S)	11. POPULATION IN LOCALITIES OF 20,000 AND OVER AS PER CENT OF TOTAL POPULATION
6. INHABITANTS PER HOSPITAL BED	12. POPULATION IN LOCALITIES OF 500,000 AND OVER AS PER CENT OF TOTAL POPULATION
	13. POPULATION IN LOCALITIES OF 100,000 AND OVER AS PER CENT OF POPULATION IN LOCALITIES OF 20,000 AND OVER
	14. AVERAGE SIZE OF PRIVATE HOUSEHOLDS
	15. PROPORTIONAL MORTALITY RATIO
NUTRITION	
16. CALORIE CONSUMPTION, PER CAPITA, PER DAY	19. CONSUMPTION OF CALORIES DERIVED FROM CEREALS AND STARCHY ROOTS AS PER CENT OF TOTAL CALORIE CONSUMPTION
17. PROTEIN CONSUMPTION, PER CAPITA, PER DAY	
18. CONSUMPTION OF ANIMAL PROTEIN, PER CAPITA, PER DAY	

DEVELOPMENTAL	STRUCTURAL

SOCIAL AND DEMOGRAPHIC

EDUCATION

20. LITERATE AS PER CENT OF TOTAL POPULATION (AGE GROUP 15 AND OVER)
21. COMBINED PRIMARY AND SECONDARY ENROLMENT AS PER CENT OF AGE GROUPE 5-19
22. PRIMARY ENROLMENT AS PER CENT OF AGE GROUP 5-14
23. SECONDARY ENROLMENT AS PER CENT OF AGE GROUP 15-19
24. VOCATIONAL ENROLMENT AS PER CENT OF AGE GROUP 15-19
25. HIGHER EDUCATION ENROLMENT PER 1,000 AGED 20-29
    PER CENT OF AGE GROUP 15 AND OVER WITH AT LEAST ONE YEAR OF ;-
26. I) PRIMARY SCHOOL EDUCATION
27. II) SECONDARY SCHOOL EDUCATION
28. III) HIGHER EDUCATION

29. FEMALE, AS PER CENT OF TOTAL, PRIMARY ENRØLMENT
30. PUPIL/TEACHER RATIO IN PRIMARY EDUCATION

HOUSING

31. AVERAGE NUMBER OF PERSONS PER ROOM
32. DWELLINGS WITH PIPED WATER AS PER CENT OF ALL DWELLINGS
33. DWELLINGS WITH ELECTRICITY AS PER CENT OF ALL DWELLINGS

COMMUNICATIONS

34. NEWSPAPER ('DAILY GENERAL INTEREST') CIRCULATION PER 1,000 POPULATION
35. TELEPHONES PER 100,000 POPULATION
36. RADIO RECEIVERS PER 1,000 POPULATION
37. TELEVISION RECEIVERS PER 1,000 POPULATION

DEVELOPMENTAL	STRUCTURAL

SOCIAL AND DEMOGRAPHIC

COMMUNICATIONS (CONTINUED)

38. RADIO AND TELEVISION RECEIVERS PER 1,000 POPULATION

ECONOMIC

TRANSPORT AND SERVICES

39. RAILWAY NET-TON KILOMETERS PER CAPITA
40. RAILWAY NET-TON KILOMETERS PER SQ. KM. (SIZE OF COUNTRY) (IN 00'S)
41. PASSENGER RAILWAY KILOMETERS PER CAPITA
42. PASSENGER RAILWAY KILOMETERS PER SQ. KM. (SIZE OF COUNTRY) (IN 00'S)
43. MOTOR VEHICLES PER 1,000 POPULATION

PER CENT OF ECONOMICALLY ACTIVE POPULATION IN:

44. I) ELECTRICITY, GAS, WATER SANITARY SERVICES, TRANSPORT, STORAGE AND COMMUNICATIONS (ISIC DIVISIONS 5,7)
45. II) ELECTRICITY, GAS, WATER AND SANITARY SERVICES (ISIC DIVISION 5)
46. III) TRANSPORT, STORAGE AND COMMUNICATIONS (ISIC DIVISION 7)

AGRICULTURE

47. AGRICULTURAL PRODUCTION PER MALE AGRICULTURAL WORKER (ISIC DIVISION 0), IN 1960 U.S. DOLLARS
48. ADULT MALE LABOUR IN AGRICULTURE AS PER CENT OF TOTAL MALE LABOUR (ISIC DIVISION 0)

INDUSTRY

49. ELECTRICITY CONSUMPTION, KWH. PER CAPITA
50. STEEL CONSUMPTION, KG. PER CAPITA
51. ENERGY CONSUMPTION, KG. OF COAL EQUIVALENT PER CAPITA
52. GDP DERIVED FROM INDUSTRY (MANUFACTURING AND MINING, ISIC DIVISIONS 1-3) AS PER CENT OF TOTAL GDP
53. PER CENT ECONOMICALLY ACTIVE POPULATION IN MANUFACTURING (ISIC DIVISIONS 2-3)
54. GDP DERIVED FROM MANUFACTURING (ISIC DIVISIONS 2-3) AS PER CENT OF TOTAL GDP

DEVELOPMENTAL	STRUCTURAL

ECONOMIC

TRADE

55. EXPORTS, IN 1960 U.S. DOLLARS, PER CAPITA
56. FOREIGN TRADE (SUM OF IMPORTS AND EXPORTS) PER CAPITA, IN 1960 U.S. DOLLARS
57. CONCENTRATION OF EXPORTS (EXPORTS OF LARGEST SINGLE ITEM, IN TERMS OF SINGLE DIGIT SITC CODE, AS PER CENT OF TOTAL EXPORTS)
58. *EXPORT CONCENTRATION INDEX
59. EXPORTS OF MANUFACTURES (SITC CODES 5 TO 8) AS PER CENT OF TOTAL EXPORTS
60. EXPORTS AS PER CENT OF GNP
61. IMPORTS AS PER CENT OF GNP
62. FOREIGN TRADE (SUM OF IMPORTS AND EXPORTS) AS PER CENT OF GNP
63. TERMS OF TRADE, AVERAGE 1950-60
64. TERMS OF TRADE, AVERAGE 1955-60

GENERAL

65. GNP PER CAPITA (1959/61), IN 1960 U.S. DOLLARS - OFFICIAL EXCHANGE RATE
66. GNP PER CAPITA (1959/61, IN 1960 U.S. DOLLARS - PARITY RATE
68. SALARIED AND WAGE EARNERS AS PER CENT OF TOTAL ECONOMICALLY ACTIVE POPULATION
69. SAVINGS AS PER CENT OF NATIONAL INCOME
70. **TOTAL STRUCTURAL DIFFERENTIAL IN PRODUCTION

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* THIS INDEX IS DETERMINED BY ASSUMING AN EQUAL DISTRIBUTION IN THE THREE SECTORS (RAW MATERIALS, MANUFACTURING PRODUCTS AND 'OTHERS' - SITC CODES 0-2 AND 4; 5-8; 3 AND 9 RESPECTIVELY) AND THEN COMPUTING THREE TIMES THE SUM OF SQUARES OF DIFFERENCES BETWEEN THE ACTUAL VALUE AND THE VALUE GIVEN BY EQUAL DISTRIBUTION IN EACH SECTOR.

** THIS INDEX IS THE SUM OF THE VALUES - IRRESPECTIVE OF SIGN - OF THE DIFFERENCES BETWEEN THE PERCENTAGE DISTRIBUTION OF GNP IN EACH SECTOR (AGRICULTURE, INDUSTRY AND 'OTHERS' - ISIC DIVISIONS 0, 1-3 AND 4-9 RESPECTIVELY) AND THE PERCENTAGE DISTRIBUTION OF THE ECONOMICALLY ACTIVE POPULATION IN THE SAME SECTOR

DEVELOPMENTAL	STRUCTURAL
ECONOMIC	
GENERAL (CONTINUED)	
67. INVESTMENT PER ECONOMICALLY ACTIVE PERSON, ANNUAL AVERAGE 1950-60, IN 1960 U.S. DOLLARS (IN 00'S)	71. GOVERNMENT CONSUMPTION EXPENDITURE AS PER CENT OF GNP 72. PRIVATE CONSUMPTION EXPENDITURE AS PER CENT OF GNP 73. EXPENDITURE ON FOOD AS PER CENT OF TOTAL PRIVATE CONSUMPTION EXPENDITURE

Chapter III

THE INITIAL INTERCORRELATIONS OF THE INDICATORS

Table 2 gives the correlation matrix for the 73 variables in 115 countries. Table 3 gives the average correlation of each variable with all other variables; also the average number of observations (countries involved) in the correlations of each variable. Some indicators are negatively correlated with most others and signs have been omitted in computation of the average correlations. Thus, the average correlation of indicator 1, infant mortality, is .60 and the average number of observations - the average of the number of countries having data on both infant mortality rate and each of the other 72 indicators - is 40 (out of a theoretical possibility of 115). In the case of some of these 72 other indicators, there are less than 20 countries with data on both infant mortality and the indicators in question. In other cases, there are more than 55 countries having data on the two indicators being correlated.

The correlation matrix in Table 2 is based on relatively crude data, which lack the adjustments and controls that are subsequently introduced in this study. A certain number of indicators tend to duplicate each other. Some of the individual correlations are obviously based upon too small a number of observations to be meaningful; or they may be limited to observations on developed countries. Nevertheless, certain general remarks can be made at this point on the basis of Tables 2 and 3:

1. There are many correlations that are quite high. In fact, it can be seen from Table 3 that there are only 9 indicators out of the 73 which have an average correlation of less than .35. 20 have an average correlation of .60 or above. In view of the imperfections of the data and of the indicators, this degree of correlation may seem surprising. One relevant fact may be the very wide range of variation of many indicators. Infant mortality rate ranges from 16 to 200, newspaper circulation per 1000 population from .20 to 514, telephones per 100,000 from 28 to 41,146, agricultural production per male agricultural worker from $146 to $3948, energy consumption from 4 to 8000 kg. of coal equivalent per capita, etc. With countries distributed along such wide ranges, individual scores could have considerable variation due to (random) error without affecting very much the over-all correlations.1/

1/ It is also possible that some of the indicators are more consistent in their behaviour than might be expected because they are better indicators than assumed. Primary and secondary school enrolment ratio, for example, is commonly criticised because it does not reflect quality of education. It is quite possible, however, that by and large, countries with higher enrolments also have better equipment, better quality teachers, fewer drop-outs, etc., so that the enrolments ratio may in fact reflect quality indirectly as well as quantity directly. This is a question for intensive study.

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2. The generally high level of correlation between these numerous variables, the fact that they tend to change en masse, illustrates the observation made in Chapter I that it is difficult on the basis of cross-national data to draw conclusions about relations of dependency or causation between developmental variables. For example, there are nearly 50 indicators that have a correlation of .70 or more with agricultural production per male agricultural worker. The variation of this indicator is "over-explained" by known correlations, to say nothing of countless unknown correlations. Thus the fact that countries high in primary and secondary school enrolment tend to be consistently high in agricultural productivity, with a correlation of .85, or the fact that each increase in educational level in the cross-national data will be found to have an increase of agricultural productivity associated with it, does not necessarily prove a dynamic impact of education on agricultural productivity in the amount indicated by the level of the correlation. Numerous other factors will show a similar relationship to agricultural productivity, and from cross-national data we can only say that school enrolment and agricultural productivity are parts of a complex of factors that tend to change together; we cannot say how much each contributes to the other.

3. In general, technically superior indicators appear to have higher correlations than inferior ones. The level of correlation may thus reflect to a considerable degree the quality and the nature of the indicators involved as well as the role of the components they represent. Low correlation between two indicators of development may reflect not lack of relationship between the components but inadequacy of the indicators. There is a corresponding implication that if indicators are improved the correlations will be higher.[1/] (Mathematical transformations will increase correlations, as demonstrated in subsequent parts of this report.) For the moment, attention can be called to examples like that of health where the expectation of life at birth and the infant mortality rate, considered to be technically the better indicators of health, have the highest average level of intercorrelation, while the other health indicators, judged to be inferior indicators, have substantially lower average correlations.

1/ Some improvements may, however, reduce correlations. Thus, since developing countries have relatively many more children in their populations than developed countries, conversion of indicators with per capita figures to "adult equivalent" figures will tend to reduce slightly the correlations of such indicators with other developmental indicators. Conversely stated, if two countries, one developed and the other developing, have exactly equivalent nutritional status in terms of the meeting of nutritional requirements of different age groups, the use of a crude per capita calorie consumption or protein consumption indicator will lower the score of the developing country (with more children) compared to the developed country and thus cause the nutritional indicator to have a greater correlation with other aspects of development.

4. Correlations between economic indicators and social indicators are often as high as, or higher than, correlations between indicators within the social sector or within the economic sector as a whole or even between indicators of the same components (indicators that overlap by definition are excluded from this statement). Life expectation, for example, has a higher correlation with literacy, housing conditions and structure of economic production than with the relative number of doctors and hospital beds. Selected statistics to demonstrate this and other cross-sectoral correlations are given in Table 4.

5. The dozen or so indicators having the highest correlations on the average with the mass of all other indicators are not concentrated in any particular field but are distributed among all major social sectors in the study, with one or two from each sector (health, nutrition, education, housing and communications), and also among most economic sectors. Indicators referring to agriculture actually have the highest average correlations with the generality of indicators - that is, the best single indicator to represent the generality of all the development indicators used in the study would be either agricultural productivity (value of production per adult male worker) or the percentage of the adult male labour force in agriculture. These have higher average correlations with other development indicators than does the per capita national income, although the difference is not great (the differences in average correlation among all the high correlate indicators are small - see below). Various trade indicators have lower correlations with other indicators of development than might be expected (the favourableness or unfavourableness of the terms of trade has practically no correlation at all). Transport would probably be better correlated with other sectors if there existed a single synthetic indicator to cover the different and alternative forms of modern transport.

6. It is evident from the two preceding paragraphs that social and economic aspects in the objective process of development are very closely interrelated, however much they may be separated in policy, administration or academic discipline. The available data do not lend support to the view that there is a general economic factor of development and a separate general social factor. It is true that the correlations of some of the social indicators with other social indicators are higher than their correlations with economic indicators, and certain agricultural and industrial indicators are highly correlated with each other (the correlation between agricultural production per male agricultural worker and steel consumption per capita is .94). But such

clusterings are still not much more pronounced than certain socio-economic clusterings. They are not found in the case of other social or economic indicators, and the general correlation picture shows no clear-cut and consistent division between the economic and the social aspects. Much depends, in fact, on the particular indicators involved.

In the final group of 18 high correlate indicators chosen for this study by processes described in the next chapter, the average correlation of the social development indicators with each other is .77, of economic development indicators with each other also .77, and of social with economic .76. (See Table 9).

7. The correlation matrix is based on data for all countries. There are, however, definite differences between the developed and developing countries in patterns of correlation, although these differences depend to some extent on how developed and developing countries are defined.[1/] With any definition, it is evident that particular indicators may have quite different correlational significance in the developed and the developing countries. Such factors as calorie consumption, literacy and primary education are important in developing countries but lose discriminatory significance in developed countries where famine is not common, literacy is practically universal, and all children usually go to primary school. Other indicators that have lesser significance as development correlates at the higher levels include: level of urbanization; newspaper circulation; electricity consumption per capita; and percentage of the economically active population in electricity, gas, water, sanitary services, transport, storage and communications.

There are, in addition, indicators that are more highly correlated with the generality of development indicators in developed than in developing countries.

1/ If $500 per capita income is used as a criterion, then inter-sectoral correlations tend to be higher in the low-income countries; more indicators have higher general levels of correlation; and social levels are more intimately connected with economic levels. When a cut-off is made at a lower point, however, these differences tend to be reduced and it becomes evident that the highest degree of inter-sectoral correlation is to be found mostly in the middle-level countries rather than in countries of least income or most income.

These include persons per room; quality of diet as measured by per cent of calories from sources other than cereals or starchy roots; and motor vehicles per thousand population. Finally, there is a third set of indicators which distinguish sharply between developed and developing countries as groups but do not distinguish well between countries within either the developed or developing group. Birth rate, child dependency ratio, average size of household and related demographic indicators tend to fall into this category - in scatter diagrams relating these variables to other indicators, two separate clusters or bunchings representing developed and developing countries are immediately visible. (See chart 19).

TABLE 2: CORRELATION MATRIX FOR THE 73 VARIABLES IN 115 COUNTRIES (1960 DATA)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2	-.928																	
3	.822	-.765																
4	.652	-.794	.565															
5	.755	-.687	.796	.726														
6	.398	-.557	.253	.315	.505													
7	.732	-.827	.372	.654	.485	.522												
8	.591	-.739	.313	.607	.346	.532	.981											
9	.543	-.650	.353	.538	.202	.327	.947	.949										
10	.732	-.845	.523	.682	.247	.222	.974	.961	.913									
11	-.652	.629	-.600	-.490	-.628	-.512	-.539	-.614	-.478	-.596								
12	-.418	.263	-.392	-.158	-.408	-.317	-.357	-.382	-.470	-.600	.783							
13	-.515	.618	-.436	-.069	-.620	-.199	-.060	-.391	-.132	-.233	.632	.477						
14	.859	-.839	.541	.304	.272	.391	.944	.904	.898	.912	-.617	-.514	-.239					
15	-.791	.905	-.175	-.731	-.765	-.522	-.940	-.878	-.863	-.934	.247	.027	-.102	-.932				
16	-.597	.763	-.606	-.624	-.508	-.380	-.770	-.738	-.640	-.751	.618	.515	.222	-.725	.793			
17	-.597	.721	-.575	-.570	-.426	-.327	-.755	-.789	-.661	-.757	.580	.449	.040	-.643	.779	.911		
18	-.726	.794	-.474	-.602	-.415	-.357	-.748	-.645	-.641	-.763	.775	.646	.258	-.819	.772	.832	.799	
19	.652	-.685	.303	.649	.550	.534	.644	.437	.512	.532	-.768	-.540	-.090	.723	-.693	-.622	-.525	-.874
20	-.740	.896	-.496	-.818	-.693	-.652	-.857	-.851	-.724	-.739	.752	.517	.194	-.751	.866	.702	.591	.799
21	-.785	.841	-.574	-.772	-.628	-.505	-.771	-.715	-.537	-.643	.844	.597	.526	-.722	.778	.770	.635	.780
22	-.659	.721	-.598	-.676	-.653	-.484	-.678	-.630	-.455	-.475	.769	.485	.553	-.523	.509	.718	.570	.653
23	-.732	.728	-.489	-.558	-.475	-.328	-.669	-.655	-.563	-.649	.800	.667	.446	-.743	.656	.583	.524	.729
24	-.648	.724	-.451	-.507	-.365	-.286	-.775	-.732	-.643	-.709	.673	.554	.280	-.792	.704	.658	.543	.731
25	-.512	.500	-.359	-.504	-.332	-.296	-.487	-.396	-.396	-.413	.576	.450	.272	-.521	.317	.547	.527	.706
26	-.575	.581	-.346	-.840	-.607	-.595	-.861	-.860	-.760	-.746	.360	.171	.060	-.745	.881	.550	.540	.664
27	-.412	.434	-.342	-.347	-.318	-.484	-.200	-.276	-.215	-.326	.821	.694	.384	-.412	.284	.483	.480	.794
28	-.409	.396	-.222	-.516	-.266	-.415	-.307	-.388	-.284	-.355	.605	.544	.467	-.403	.341	.490	.443	.725
29	-.721	.624	-.758	-.546	-.592	-.412	-.700	-.657	-.380	-.339	.714	.453	.551	-.526	.650	.559	.357	.548
30	.430	-.410	.577	.173	.223	.163	.516	.527	.373	.469	-.470	-.472	-.406	.607	-.457	-.296	-.239	-.461
31	.806	-.839	.576	.762	.642	.690	.788	.709	.769	.836	-.684	-.564	-.278	.871	-.759	-.768	-.751	-.831
32	-.697	.690	-.458	-.604	-.529	-.560	-.461	-.357	-.544	-.604	.480	.043	.190	-.813	.488	.512	.589	.735
33	-.812	.877	-.448	-.777	-.421	-.706	-.694	-.634	-.676	-.755	.602	.428	.182	-.816	.733	.761	.734	.877
34	-.753	.770	-.462	-.553	-.454	-.374	-.757	-.743	-.685	-.778	.804	.689	.306	-.836	.762	.743	.708	.850
35	-.602	.623	-.331	-.446	-.306	-.389	-.608	-.569	-.555	-.690	.644	.422	.282	-.685	.630	.652	.596	.803
36	-.618	.627	-.352	-.417	-.358	-.339	-.635	-.557	-.520	-.609	.689	.537	.308	-.686	.591	.619	.565	.783
37	-.467	.449	-.161	-.318	-.206	-.275	-.404	-.328	-.387	-.462	.548	.460	.287	-.480	.419	.398	.346	.557

TABLE 2: CORRELATION MATRIX FOR THE 73 VARIABLES IN 115 COUNTRIES (1960 DATA) (Continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
38	-.594	.586	-.265	-.333	-.302	-.392	-.552	-.484	-.504	-.551	.612	.451	.306	-.617	.546	.537	.497	.724
39	-.461	.443	-.314	-.263	-.276	-.334	-.411	-.363	-.402	-.516	.460	.501	.258	-.455	.361	.475	.480	.613
40	-.421	.405	-.189	-.192	-.258	-.307	-.535	-.528	-.544	-.551	.390	.459	.209	-.529	.435	.351	.341	.349
41	-.502	.504	-.319	-.306	-.331	-.312	-.591	-.644	-.660	-.702	.498	.492	.189	-.712	.383	.372	.402	.405
42	-.346	.331	-.253	-.061	-.252	-.142	-.338	-.370	-.405	-.463	.390	.319	.100	-.417	.143	.115	.147	.114
43	-.504	.511	-.223	-.369	-.265	-.348	-.421	-.353	-.402	-.486	.575	.442	.362	-.568	.470	.521	.492	.744
44	-.770	.828	-.654	-.542	-.530	-.515	-.713	-.625	-.617	-.721	.749	.447	-.111	-.743	.606	.727	.695	.854
45	-.656	.740	-.630	-.447	-.472	-.447	-.578	-.417	-.473	-.483	.618	.291	-.071	-.547	.362	.663	.637	.753
46	-.755	.804	-.627	-.629	-.527	-.505	-.706	-.629	-.619	-.732	.628	.412	-.173	-.748	.604	.708	.677	.838
47	-.775	.774	-.483	-.718	-.310	-.480	-.739	-.704	-.681	-.746	.776	.668	.115	-.778	.731	.690	.637	.871
48	.791	-.854	.671	.696	.470	.654	.748	.718	.679	.778	-.892	-.603	-.354	.799	-.703	-.701	-.723	-.833
49	-.538	.554	-.280	-.400	-.317	-.270	-.532	-.494	-.484	-.608	.530	.365	.252	-.629	.534	.525	.465	.678
50	-.675	.683	-.229	-.637	-.377	-.432	-.683	-.588	-.628	-.720	.606	.465	.192	-.789	.688	.571	.516	.725
51	-.606	.629	-.325	-.449	-.357	-.323	-.627	-.592	-.539	-.624	.723	.566	.372	-.670	.628	.649	.564	.758
52	-.633	.706	-.309	-.528	-.435	-.406	-.692	-.724	-.576	-.735	.589	.513	.213	-.726	.801	.563	.547	.608
53	-.720	.778	-.525	-.555	-.515	-.484	-.776	-.773	-.727	-.855	.780	.650	.012	-.823	.623	.688	.627	.800
54	-.706	.782	-.304	-.505	-.427	-.407	-.875	-.887	-.766	-.885	.766	.742	.402	-.868	.864	.728	.685	.811
55	-.577	.515	-.395	-.349	-.334	-.391	-.471	-.401	-.512	-.624	.648	.588	.299	-.663	.443	.636	.524	.729
56	-.592	.544	-.422	-.357	-.338	-.414	-.460	-.404	-.546	-.662	.650	.583	.292	-.697	.432	.663	.547	.744
57	.393	-.505	.291	.601	.382	.131	.617	.728	.531	.657	-.564	-.351	-.363	.515	-.648	-.572	-.628	-.569
58	.466	-.449	.245	.443	.331	.119	.463	.545	.451	.652	-.426	-.390	-.364	.461	-.433	-.420	-.411	-.374
59	-.562	.617	-.295	-.421	-.360	-.240	-.690	-.757	-.702	-.844	.507	.360	.283	-.686	.589	.498	.532	.514
60	-.216	.187	-.150	-.249	-.047	-.235	-.020	-.024	.007	-.163	-.108	-.314	-.122	-.267	.328	.086	-.017	.089
61	-.253	.256	-.322	-.233	.000	-.178	.054	.106	-.007	-.073	-.074	-.294	-.017	-.168	.184	.105	.000	.042
62	-.241	.227	-.239	-.249	-.027	-.222	.016	.044	.000	-.122	-.092	-.310	-.068	-.228	.255	.102	-.010	.071
63	.021	.019	-.182	.195	.168	.104	.358	.169	.231	.229	.075	.028	-.148	.143	-.462	-.085	-.008	.007
64	.129	-.094	-.136	.258	.161	.053	.337	.161	.225	.174	.094	.046	-.072	.151	-.486	-.137	-.057	.024
65	-.703	.731	-.437	-.492	-.372	-.439	-.674	-.583	-.588	-.661	.731	.534	.208	-.736	.666	.703	.657	.835
66	-.713	.745	-.439	-.516	-.396	-.455	-.701	-.597	-.642	-.734	.723	.523	.124	-.786	.715	.740	.676	.854
67	-.659	.633	-.477	-.411	-.461	-.424	-.476	-.329	-.383	-.500	.570	.353	.149	-.525	.548	.503	.476	.731
68	-.738	.740	-.607	-.489	-.569	-.548	-.608	-.527	-.498	-.598	.849	.584	.217	-.722	.430	.590	.559	.789
69	-.720	.617	-.443	-.427	-.213	-.109	-.530	-.512	-.524	-.519	.112	.047	-.213	-.666	.610	.372	.346	.286
70	.594	-.693	.419	.720	.394	.432	.694	.821	.621	.715	-.724	-.542	-.101	.706	-.782	-.474	-.334	-.759
71	-.540	.482	-.318	-.445	.257	-.058	.045	-.082	-.006	-.111	.152	.135	-.180	-.382	.487	.331	.212	.259
72	.643	-.602	.370	.567	.318	.182	.489	.584	.410	.543	-.310	-.258	.124	.687	-.755	-.489	-.453	-.467
73	.524	-.554	.104	.546	.446	.539	.493	.433	.411	.517	-.452	-.044	-.023	.551	-.403	-.631	-.615	-.740

TABLE 2: CORRELATION MATRIX FOR THE 73 VARIABLES IN 115 COUNTRIES (1960 DATA) (Continued)

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
20	-.767																	
21	-.715	.948																
22	-.611	.910	.966															
23	-.591	.755	.811	.650														
24	-.693	.730	.717	.595	.391													
25	-.611	.554	.689	.635	.657	.851												
26	-.523	.793	.624	.570	.473	.635	.348											
27	-.731	.631	.714	.504	.749	.529	.833	.380										
28	-.507	.564	.582	.485	.609	.745	.986	.375	.840									
29	-.421	.832	.799	.800	.588	.549	.509	.594	-.099	.031								
30	.595	-.301	-.399	-.325	-.348	-.322	-.240	-.207	-.247	.020	-.275							
31	.698	-.730	-.871	-.699	-.780	-.813	-.543	-.740	-.585	-.585	-.568	.653						
32	-.555	.687	.748	.554	.757	.804	.533	.620	.589	.538	.263	-.277	-.886					
33	-.668	.648	.748	.604	.700	.722	.495	.679	.645	.630	.303	-.474	-.822	.795				
34	-.697	.764	.804	.621	.901	.844	.600	.573	.514	.438	.563	-.415	-.773	.686	.804			
35	-.804	.635	.653	.511	.738	.766	.735	.518	.825	.791	.418	-.342	-.731	.734	.633	.858		
36	-.746	.623	.694	.598	.701	.838	.874	.471	.809	.809	.585	-.426	-.671	.649	.658	.875	.860	
37	-.574	.461	.512	.397	.626	.657	.718	.360	.863	.768	.298	-.205	-.540	.500	.534	.699	.755	.855
38	-.688	.572	.652	.531	.682	.808	.864	.440	.835	.805	.515	-.358	-.628	.610	.622	.834	.852	.990
39	-.558	.425	.551	.537	.481	.576	.741	.449	.824	.679	.292	-.284	-.485	.479	.500	.458	.718	.798
40	-.156	.445	.531	.489	.457	.803	.394	.314	.116	.132	.333	-.252	-.346	.158	.454	.432	.240	.402
41	-.175	.510	.568	.477	.626	.810	.341	.324	.139	.244	.403	-.373	-.460	.342	.548	.693	.457	.368
42	.071	.313	.384	.265	.567	.745	.138	-.005	.125	.232	.284	-.163	-.244	.113	.380	.506	.199	.151
43	-.742	.491	.593	.483	.653	.732	.799	.385	.901	.854	.358	-.270	-.645	.713	.578	.727	.915	.882
44	-.803	.797	.810	.724	.715	.796	.492	.561	.474	.360	.525	-.463	-.803	.747	.865	.823	.704	.611
45	-.741	.712	.676	.723	.508	.675	.587	.363	.536	.567	.420	-.212	-.638	.567	.631	.627	.510	.593
46	-.775	.781	.753	.682	.724	.808	.446	.566	.431	.293	.518	-.468	-.793	.732	.859	.826	.710	.594

TABLE 2: CORRELATION MATRIX FOR THE 73 VARIABLES IN 115 COUNTRIES (1960 DATA) (Continued)

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
47	-.834	.76[illegible]	.848	.7[illegible]9	.868	.905	.748	.482	.916	.825	.419	-.467	-.812	.756	.796	.855	.887	.887
48	.770	-.83[illegible]	-.83[illegible]	-.[illegible]55	-.813	-.813	-.661	-.418	-.733	-.631	-.549	.464	.881	-.832	-.834	-.849	-.690	-.671
49	-.678	.565	.533	.451	.665	.734	.506	.486	.577	.438	.367	-.310	-.655	.692	.651	.747	.843	.744
50	-.766	.725	.720	.643	.728	.790	.630	.629	.665	.609	.549	-.517	-.695	.614	.762	.833	.787	.785
51	-.768	.649	.688	.623	.718	.848	.747	.484	.787	.681	.506	-.374	-.683	.583	.715	.819	.822	.905
52	-.581	.701	.649	.553	.565	.537	.447	.643	.586	.539	.362	-.315	-.728	.687	.767	.723	.530	.532
53	-.744	.832	.746	.615	.714	.814	.464	.523	.522	.538	.556	-.527	-.845	.723	.793	.835	.673	.601
54	-.613	.755	.779	661	.808	.800	.592	.771	.731	.696	.577	-.511	-.845	.726	.792	.834	.646	.513
55	-.765	.638	.630	.491	.618	.795	.390	.495	.569	.479	.381	-.329	-.743	.739	.723	.842	.636	.495
56	-.783	.664	.631	.504	.622	.852	.372	.465	.486	.400	.379	-.369	-.763	.770	.735	.851	.636	.495
57	.280	-.436	-.535	-.503	-.583	-.556	-.455	-.173	-.448	-.498	-.325	.237	.441	-.423	-.496	-.606	-.499	-.422
58	.217	-.365	-.497	-.523	-.565	-.596	-.480	-.254	-.358	-.264	-.281	.297	.279	-.430	-.464	-.420	-.411	-.408
59	-.280	.616	.565	.498	.688	.616	.423	.421	.555	.591	.346	-.415	-.566	.588	.663	.707	.540	.506
60	-.286	.214	.152	.163	.141	.451	-.068	.223	-.163	-.049	-.076	-.096	-.208	.308	.310	.180	.078	-.029
61	-.198	.182	.066	.221	.064	.461	-.041	-.058	-.280	-.180	-.046	.074	-.171	.157	-.012	.118	-.037	-.114
62	-.252	.204	.119	.204	.108	.482	-.057	.075	-.239	-.126	-.065	-.014	-.197	.239	.144	.153	.020	-.075
63	.048	-.063	-.131	-.233	-.099	-.144	-.166	-.583	-.139	-.250	-.140	.127	-.052	.134	-.010	.018	.011	-.175
64	-.040	.050	.013	-.132	-.059	-.033	-.151	-.133	-.016	-.269	-.032	.053	-.008	.102	-.136	-.007	.042	-.115
65	-.848	.701	.774	.693	.775	.783	.813	.540	.899	.821	.508	-.366	-.773	.763	.764	.873	.929	.926
66	-.868	.729	.805	.725	.813	.832	.784	.561	.848	.811	.492	-.499	-.823	.844	.790	.871	.950	.878
67	-.742	.549	.720	.711	.641	.576	.671	.464	.843	.664	.209	-.284	-.612	.688	.625	.623	.849	.798
68	-.857	.772	.735	.697	.602	.647	.523	.422	.523	.433	.608	-.383	-.824	.726	.724	.728	.668	.659
69	.017	.441	.453	.269	.647	.611	.053	.381	-.005	.138	.256	-.343	-.368	.378	.500	.676	.318	.218
70	.735	-.783	-.725	-.582	-.767	-.657	-.645	-.534	-.699	-.625	-.381	.565	.741	-.565	-.672	-.705	-.664	-.619
71	-.368	.285	.048	.257	.084	-.022	.384	.499	.655	.477	-.210	.166	-.548	.551	.474	.285	.190	.112
72	.385	-.634	-.473	-.359	-.621	-.478	-.326	-.534	-.417	-.381	-.215	.284	.624	-.606	-.680	-.639	-.521	-.436
73	.734	-.622	-.737	-.670	-.496	-.667	-.576	-.617	-.611	-.662	-.557	.292	.690	-.771	-.698	-.670	-.687	-.771

TABLE 2: CORRELATION MATRIX FOR THE 73 VARIABLES IN 115 COUNTRIES (1960 DATA) (Continued)

	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
38	.920																	
39	.830	.874																
40	.304	.354	.439															
41	.265	.289	.338	.755														
42	.202	.110	.086	.624	.791													
43	.816	.894	.856	.317	.247	.040												
44	.394	.511	.381	.206	.387	.206	.539											
45	.424	.507	.402	.206	.217	.151	.439	.818										
46	.373	.492	.362	.262	.380	.194	.527	.993	.747									
47	.823	.875	.713	.689	.620	.507	.840	.774	.688	.751								
48	-.522	-.636	-.477	-.532	-.525	-.401	-.570	-.871	-.809	-.840	-.875							
49	.622	.720	.656	.224	.399	.157	.740	.744	.461	.770	.697	-.598						
50	.719	.769	.672	.626	.561	.340	.734	.651	.555	.610	.940	-.806	.716					
51	.848	.914	.868	.538	.423	.229	.866	.647	.595	.628	.919	-.705	.770	.887				
52	.467	.495	.429	.569	.583	.370	.412	.763	.649	.747	.732	-.821	.471	.639	.625			
53	.459	.513	.356	.592	.600	.460	.483	.809	.695	.796	.858	-.906	.570	.786	.622	.873		
54	.583	.624	.447	.695	.712	.472	.498	.761	.659	.661	.811	-.844	.567	.821	.690	.914	.950	
55	.363	.407	.399	.447	.471	.298	.653	.784	.629	.785	.765	-.732	.567	.694	.571	.624	.741	.610
56	.331	.422	.369	.418	.479	.305	.621	.824	.662	.826	.778	-.760	.577	.696	.540	.590	.774	.632
57	-.339	-.319	-.433	-.443	-.499	-.368	-.442	-.457	-.347	-.460	-.531	.578	-.480	-.480	-.498	-.587	-.569	-.625
58	-.325	-.396	-.383	-.209	-.202	-.110	-.374	-.383	-.349	-.374	-.428	.430	-.416	-.324	-.476	-.615	-.342	-.543
59	.424	.451	.329	.688	.679	.627	.413	.576	.583	.590	.754	-.738	.543	.676	.571	.812	.820	.847
60	-.166	-.104	-.323	.024	.038	.035	-.051	.380	.359	.361	.157	-.213	.168	-.031	.008	.208	.181	.016
61	-.249	-.164	-.320	-.032	-.034	-.030	-.128	.327	.396	.293	.083	-.174	.062	-.108	-.115	-.110	.099	-.134
62	-.212	-.138	-.327	-.005	.003	.004	-.097	.363	.389	.335	.121	-.203	.121	-.070	-.056	.056	.143	-.059
63	-.210	-.163	-.121	-.414	-.191	-.271	-.047	.091	-.052	.066	-.337	-.048	-.023	-.205	-.122	-.250	-.217	-.265
64	-.209	-.145	-.073	-.306	-.182	-.231	.013	.157	-.040	.186	-.245	-.073	.035	-.213	-.091	-.274	-.088	-.318
65	.907	.917	.794	.396	.406	.157	.916	.769	.703	.742	.933	-.827	.817	.886	.934	.628	.755	.690
66	.734	.861	.733	.425	.444	.192	.915	.808	.801	.787	.944	-.858	.824	.908	.909	.641	.814	.731
67	.703	.804	.777	.121	.016	-.114	.859	.734	.636	.712	.767	-.716	.819	.657	.865	.564	.512	.420
68	.518	.608	.452	.323	.402	.231	.607	.832	.750	.810	.731	-.835	.591	.718	.659	.685	.848	.728
69	.145	.199	.000	.460	.701	.661	.071	.312	.084	.335	.328	-.448	.298	.441	.295	.575	.444	.617
70	-.512	-.597	-.434	-.495	-.616	-.391	-.528	-.769	-.686	-.740	-.788	.854	-.568	-.725	-.632	-.604	-.842	-.810
71	.241	.156	.431	.190	-.063	-.055	.200	.463	.524	.450	.587	-.382	.150	.130	.202	.172	.335	.185
72	-.346	-.419	-.347	-.572	-.624	-.543	-.316	-.561	-.209	-.513	-.591	.558	-.514	-.611	-.503	-.654	-.609	-.606
73	-.512	-.711	-.429	-.200	-.383	-.061	-.758	-.780	-.631	-.758	-.711	.595	-.567	-.532	-.685	-.652	-.601	-.556

TABLE 2: CORRELATION MATRIX FOR THE 73 VARIABLES IN 115 COUNTRIES (1960 DATA)

	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
56	.986																	
57	-.340	-.371																
58	-.416	-.427	.601															
59	.471	.474	-.632	-.608														
60	.513	.529	-.024	-.117	.098													
61	.270	.369	-.009	-.088	-.015	.762												
62	.421	.483	-.017	-.105	.042	.940	.937											
63	.008	-.002	.136	-.055	-.250	.028	.024	.027										
64	.068	.034	.123	.000	-.232	.155	.070	.117	.791									
65	.784	.782	-.491	-.472	.637	.079	-.022	.029	-.065	-.034								
66	.788	.800	-.534	-.417	.625	.102	.016	.065	-.056	-.014	.977							
67	.714	.687	-.336	-.558	.409	.141	.015	.076	.214	.139	.916	.868						
68	.693	.708	-.367	-.414	.581	.261	.166	.222	.148	.200	.748	.776	.651					
69	.409	.411	-.359	-.261	.620	.269	.082	.180	-.247	-.446	.297	.319	.191	.253				
70	-.594	-.646	.425	.448	-.647	-.233	-.231	-.239	-.043	-.095	-.691	-.730	-.602	-.750	-.297			
71	.144	.181	-.277	-.179	.278	.137	.258	.205	-.376	-.256	.307	.348	.631	.326	.204	-.286		
72	-.587	-.563	.471	.447	-.753	-.328	-.006	-.181	.265	.203	-.540	-.561	-.508	-.453	-.894	.429	-.344	
73	-.706	-.686	.471	.545	-.518	-.576	-.247	-.433	.010	-.073	-.758	-.748	-.633	-.710	-.150	.506	-.075	.507

Table 3: AVERAGE CORRELATION AND AVERAGE NUMBER OF OBSERVATIONS OF EACH VARIABLE WITH ALL OTHER VARIABLES

Indicator	Average Correlation	Average Number of Observations
1. INFANT MORTALITY RATE	.601	40
2. EXPECTATION OF LIFE AT BIRTH	.615	39
3. CRUDE DEATH RATE	.417	40
4. DEATH RATE DUE TO INFECTIOUS AND PARASITIC DISEASES, PER 100,000 POPULATION	.504	28
5. INHABITANTS PER PHYSICIAN (IN 000'S)	.409	46
6. INHABITANTS PER HOSPITAL BED	.377	49
7. CRUDE BIRTH RATE	.585	40
8. GROSS REPRODUCTION RATE	.557	39
9. DEPENDENCY RATIO (CHILDREN AGED UNDER 15 PLUS PERSONS AGED 65 AND OVER AS PER CENT OF AGE GROUP 15-64)	.516	55
10. CHILD DEPENDENCY RATIO (CHILDREN AGED UNDER 15 AS PER CENT OF AGE GROUP 15-64)	.598	41
11. POPULATION IN LOCALITIES OF 20,000 AND OVER AS PER CENT OF TOTAL POPULATION	.570	37
12. POPULATION IN LOCALITIES OF 500,000 AND OVER AS PER CENT OF TOTAL POPULATION	.432	38
13. POPULATION IN LOCALITIES OF 100,000 AND OVER AS PER CENT OF POPULATION IN LOCALITIES OF 20,000 AND OVER	.247	38
14. AVERAGE SIZE OF PRIVATE HOUSEHOLDS	.634	35
15. PROPORTIONAL MORTALITY RATIO	.581	28
16. CALORIE CONSUMPTION, PER CAPITA, PER DAY	.559	43
17. PROTEIN CONSUMPTION, PER CAPITA, PER DAY	.512	43

Table 3: AVERAGE CORRELATION AND AVERAGE NUMBER OF OBSERVATIONS OF EACH VARIABLE WITH ALL OTHER VARIABLES (Continued)

Indicator	Average Correlation	Average Number of Observations
18. CONSUMPTION OF ANIMAL PROTEIN, PER CAPITA, PER DAY	.629	44
19. CONSUMPTION OF CALORIES DERIVED FROM CEREALS AND STARCHY ROOTS AS PER CENT OF TOTAL CALORIE CONSUMPTION	.573	30
20. LITERATE AS PER CENT OF TOTAL POPULATION (AGE GROUP 15 AND OVER)	.622	32
21. COMBINED PRIMARY AND SECONDARY ENROLMENT AS PER CENT OF AGE GROUP 5-19	.635	53
22. PRIMARY ENROLMENT AS PER CENT OF AGE GROUP 5-14	.560	47
23. SECONDARY ENROLMENT AS PER CENT OF AGE GROUP 15-19	.606	50
24. VOCATIONAL ENROLMENT AS PER CENT OF AGE GROUP 15-19	.649	31
25. HIGHER EDUCATION ENROLMENT PER 1,000 AGED 20-29	.507	41
PER CENT OF AGE GROUP 15 AND OVER WITH AT LEAST ONE YEAR OF:-		
26. I) PRIMARY SCHOOL EDUCATION	.493	16
27. II) SECONDARY SCHOOL EDUCATION	.520	17
28. III) HIGHER EDUCATION	.488	18
29. FEMALE, AS PER CENT OF TOTAL, PRIMARY ENROLMENT	.439	42
30. PUPIL/TEACHER RATIO IN PRIMARY EDUCATION	.345	45
31. AVERAGE NUMBER OF PERSONS PER ROOM	.642	30
32. DWELLINGS WITH PIPED WATER AS PER CENT OF ALL DWELLINGS	.561	23
33. DWELLINGS WITH ELECTRICITY AS PER CENT OF ALL DWELLINGS	.620	25

Table 3: AVERAGE CORRELATION AND AVERAGE NUMBER OF OBSERVATIONS OF EACH VARIABLE WITH ALL OTHER VARIABLES (Continued)

Indicator	Average Correlation	Average Number of Observations
34. NEWSPAPER ('DAILY GENERAL INTEREST') CIRCULATION PER 1,000 POPULATION	.651	43
35. TELEPHONES PER 100,000 POPULATION	.584	54
36. RADIO RECEIVERS PER 1,000 POPULATION	.583	52
37. TELEVISION RECEIVERS PER 1,000 POPULATION	.475	46
38. RADIO AND TELEVISION RECEIVERS PER 1,000 POPULATION	.552	43
39. RAILWAY NET-TON KILOMETRES PER CAPITA	.470	34
40. RAILWAY NET-TON KILOMETRES PER SQ. KM. (SIZE OF COUNTRY) (IN 00'S)	.383	34
41. PASSENGER RAILWAY KILOMETRES PER CAPITA	.426	45
42. PASSENGER RAILWAY KILOMETRES PER SQ. KM. (SIZE OF COUNTRY) (IN 00'S)	.272	45
43. MOTOR VEHICLES PER 1,000 POPULATION	.522	45
PER CENT OF ECONOMICALLY ACTIVE POPULATION IN:		
44. (I) ELECTRICITY, GAS, WATER, SANITARY SERVICES, TRANSPORT, STORAGE AND COMMUNICATIONS (ISIC DIVISIONS 5,7)	.617	37
45. (II) ELECTRICITY, GAS, WATER AND SANITARY SERVICES (ISIC DIVISION 5)	.520	38
46. (III) TRANSPORT, STORAGE AND COMMUNICATIONS (ISIC DIVISION 7)	.601	38
47. AGRICULTURAL PRODUCTION PER MALE AGRICULTURAL WORKER (ISIC DIVISION 0), IN 1960 U.S. DOLLARS	.683	32
48. ADULT MALE LABOUR IN AGRICULTURE AS PER CENT OF TOTAL MALE LABOUR (ISIC DIVISION 0)	.659	37

Table 3: AVERAGE CORRELATION AND AVERAGE NUMBER OF OBSERVATIONS (Continued)
OF EACH VARIABLE WITH ALL OTHER VARIABLES

Indicator	Average Correlation	Average Number of Observations
49. ELECTRICITY CONSUMPTION, KWH. PER CAPITA	.516	58
50. STEEL CONSUMPTION, KG. PER CAPITA	.605	41
51. ENERGY CONSUMPTION, KG. OF COAL EQUIVALENT PER CAPITA	.596	58
52. GDP DERIVED FROM INDUSTRY (MANUFACTURING AND MINING, ISIC DIVISIONS 1-3) AS PER CENT OF TOTAL GDP	.564	38
53. PER CENT ECONOMICALLY ACTIVE POPULATION IN MANUFACTURING (ISIC DIVISIONS 2-3)	.623	37
54. GDP DERIVED FROM MANUFACTURING (ISIC DIVISIONS 2-3) AS PER CENT OF TOTAL GDP	.644	33
55. EXPORTS, IN 1960 U.S. DOLLARS, PER CAPITA	.547	53
56. FOREIGN TRADE (SUM OF IMPORTS AND EXPORTS) PER CAPITA, IN 1960 U.S. DOLLARS	.554	52
57. CONCENTRATION OF EXPORTS (EXPORTS OF LARGEST SINGLE ITEM, IN TERMS OF SINGLE DIGIT SITC CODE, AS PER CENT OF TOTAL EXPORTS)	.437	44
58. EXPORT CONCENTRATION INDEX	.380	43
59. EXPORTS OF MANUFACTURES (SITC CODES 5 TO 8) AS PER CENT OF TOTAL EXPORTS	.528	43
60. EXPORTS AS PER CENT OF GNP	.194	38
61. IMPORTS AS PER CENT OF GNP	.157	38
62. FOREIGN TRADE (SUM OF IMPORTS AND EXPORTS) AS PER CENT OF GNP	.177	38
63. TERMS OF TRADE, AVERAGE 1950-60	.152	36

Table 3: AVERAGE CORRELATION AND AVERAGE NUMBER OF OBSERVATIONS OF EACH VARIABLE WITH ALL OTHER VARIABLES (Continued)

Indicator	Average Correlation	Average Number of Observations
64. TERMS OF TRADE, AVERAGE 1955-60	.141	38
65. GNP PER CAPITA (1959/61), IN 1960 U.S. DOLLARS - OFFICIAL EXCHANGE RATE	.639	46
66. GNP PER CAPITA (1959/61), IN 1960 U.S. DOLLARS - PARITY RATE	.654	39
67. INVESTMENT PER ECONOMICALLY ACTIVE PERSON, ANNUAL AVERAGE 1950-60, IN 1960 U.S. DOLLARS (IN 00'S)	.541	30
68. SALARIED AND WAGE EARNERS AS PER CENT OF TOTAL ECONOMICALLY ACTIVE POPULATION	.583	39
69. SAVINGS AS PER CENT OF NATIONAL INCOME	.356	29
70. TOTAL STRUCTURAL DIFFERENTIAL IN PRODUCTION	.579	27
71. GOVERNMENT CONSUMPTION EXPENDITURE AS PER CENT OF GNP	.275	38
72. PRIVATE CONSUMPTION EXPENDITURE AS PER CENT OF GNP	.473	36
73. EXPENDITURE ON FOOD AS PER CENT OF TOTAL PRIVATE CONSUMPTION EXPENDITURE	.528	27

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Table 4: ILLUSTRATIVE INTRA-SECTORAL AND CROSS SECTORAL CORRELATIONS

1. Correlation of expectation of life at birth with:	
inhabitants per hospital bed	(-).56
inhabitants per physician	(-).69
literate as per cent of total population (age group 15 and over)	.90
dwellings with electricity as per cent of all dwellings	.88
adult male labour in agriculture as per cent of total male labour	(-).85
per cent of economically active population in electricity, gas, water, sanitary services, transport, storage and communications (ISIC divisions 5, 7)	.83
GDP derived from manufacturing as per cent of total GDP (ISIC division 2-3)	.78
2. Correlation of agricultural production per male agricultural worker, in 1960 U.S. dollars with:	
infant mortality rate	(-).78
average size of private households	(-).78
combined primary and secondary enrolment as per cent of age group 5-19	.85
vocational enrolment as per cent of age group 15-19	.91
newspaper ('daily general interest') circulation per 1,000 population	.86
exports, in 1960 U.S. dollars, per capita	.77
energy consumption, kg. of coal equivalent per capita	.92
savings as per cent of national income	.33
terms of trade, average 1950-60	(-).34
3. Correlation of steel consumption, kg. per capita, with:	
average size of private households	(-).79
consumption of animal protein, per capita, per day	.73
literate as per cent of total population (age group 15 and over)	.73
newspaper ('daily general interest') circulation per 1,000 population	.83
GDP derived from industry (manufacturing and mining, ISIC divisions 1-3) as per cent of total GDP	.64
investment per economically active person, annual average 1950-1960, in 1960 U.S. dollars	.66
electricity consumption, kwh. per capita	.72
energy consumption, kg. of coal equivalent per capita	.89
passenger railway kilometres per capita	.56

Chapter IV
THE SELECTION OF KEY VARIABLES[1/]

The Data Bank described in Chapter III contains a large number of indicators, some partial duplicates of each other, some more significant than others. In order to avoid duplication and eliminate the more peripheral indicators, it was decided to select a core of indicators that, given available data, would best distinguish more developed from less developed countries. As noted in Chapter I, we have gone on the assumption that in socio-economic development different elements will of necessity tend to be correlated. This does not imply that the different elements are redundant (or that one element correlates with another because it is the simple and direct cause or consequence of the other). It would be imprudent to conclude that steel consumption and circulation of newspapers are duplicate measures of the same thing because they are highly correlated. The assumption of high correlation among the factors of development could, of course, be denied by the empirical data but, in fact, the data demonstrate and confirm it.

The selection from the 73 indicators was carried out in two stages. At the first stage, a set of 42 indicators, called the "reservoir", was chosen. At the second, more intensive stage, a highly intercorrelated "core" of indicators was selected from the reservoir - initially 24 but eventually reduced to 18. This approach allowed a reasoned-procedure at successive steps and the use of judgement on certain issues where the application of purely mechanical statistical procedures would not make sense. It also allowed a certain flexibility. For example, some overlapping or partial duplication was deliberate in the initial list of 73 indicators, to permit experimentation with more indicators than would be necessary at a later stage of the analysis. By this means the more significant indicators could be chosen from among alternatives in a given sector, and the duplication could be eventually eliminated.

1/ What is presented here is a description of the procedure adopted finally for this analysis; it must be recorded that the actual research procedure went through several stages, experimental testings and approximation exercises before it was finalized and adopted. There have also been a few slight changes in the original list of indicators, additions of information, and re-runs with corrections, so that the figures here presented are not always exactly the same as those in Research Notes 1 and 2.

This method was considered preferable to other possible procedures, such as "factor analysis" or "principle component analysis", which mechanically process the original data without further selection or intervention. Use of such methods can lead to results too dependent upon the necessarily imperfect set of original indicators.[1/] The original set might be strongly biased by the accidents of data availability (e.g., numerous overlapping indicators in one or two fields). A selection process might, of course, be carried out but this would involve quite arbitrary choice or necessitate a procedure eventually similar to the one followed here.

In the selection for the reservoir, a few indicators with low average inter-correlation were simply dropped out. So also were indicators covering a very few countries or having correlations that were not statistically significant given the number of observations. Coverage of sectors or components was considered as well as coverage of countries in making selections. In many cases the process of selection was a matter of choosing, on the basis of average correlations (and their significance) from among duplicating or alternative measures of the same components. Attention was also paid to the matter of balance between social and economic indicators and between the structural and the development indicators. A few comments on indicators excluded from the reservoir will illustrate the application of the criteria.

The exclusion of the terms of trade - on the basis of lack of correlation with the mass of development indicators - may occasion some surprise.[2/] The terms of trade are not really significant in a cross-national study dealing with a single point of time. Their exclusion here does not necessarily mean that in individual countries the terms of trade are not an important factor in time perspective affecting changes in the national income.

Several other trade indicators were dropped because of low correlations, or insufficient number of observations to make the correlations statistically significant. So also various indicators concerned with distribution of urban population, pupil-teacher ratio, railway transport, savings as per cent of national

---

1/ This is a second reason for not using factor analysis. The first reason - the programming requirement in factor analysis that data be available for all indicators for all countries involved in the analysis - has been mentioned above. At the same time, the procedure we have used has certain similarities to factor analysis - the average intercorrelations of indicators, for example, are equivalent to "factor loadings."

2/ But see the study of A.I. Macbean, Export Instability and Economic Development, George Allen and Unwin, London 1966.

income (although investment per economically active person was retained), and government consumption expenditure as per cent of GNP. In the case of three educational indicators: percentage of the population with at least one year of primary education, or secondary education, or higher education - indicators which in theory might be considered superior to school enrolment indicators - lack of data was the major reason for exclusion.

As noted above, in the case of a number of overlapping, duplicating or complementary indicators, selection among them was generally made on the basis of level of average correlation. Thus, birth rate was chosen over gross reproduction rate as an indicator of fertility, and average size of private households over dependency ratios as an indicator of demographic structure, on the basis of somewhat higher correlations.

The per capita income was qualified for inclusion in the reservoir on most counts but was nevertheless excluded because it is an aggregative index par excellence, having a different character from the other indicators and by its nature embracing a number of the other indicators, directly or indirectly. However, the per capita income figures prominently in the subsequent analysis.

Table 5 presents the Reservoir as finally chosen. It contains 42 indicators out of the original set of 73. Of the 42 indicators, 29 are developmental and 13 structural. 24 are social and 18 are economic.

The high correlate core of development indicators

The next stage of the analysis was the selection of the high correlate core of development indicators. The first step was to refine the indicators where possible. In particular, indicators of a "per capita" type were adjusted to take account of the age structure of the population in the different countries. (Estimates of age structure were sometimes necessary). Thus in the case of per capita calorie consumption, it was assumed that children below 15 would need approximately one-half the calories of adults, while old people, 65 and more, would need roughly two-thirds. Birth rate was adjusted to the population 15-64. It was assumed that children would not need telephones or motor vehicles for themselves, and only half as much dwelling space as adults; that old people would need twice as many hospital beds as others in the population; etc. These rough adjustments reduced the correlations somewhat but had no serious effect on the final selection of indicators, except for the elimination of per capita calorie consumption. Per capita animal protein intake,

however, which is considered a technically superior indicator, remained on the list. (The adjustments are shown in Table 10, in the case of the indicators finally selected for the core)..

For the inclusion of an indicator in the core more stringent criteria than those used for the reservoir were laid down.[1/] As most of the indicators already had an average correlation coefficient that was significant at the 1 per cent level, the requirement was laid down that the indicator must have an average correlation coefficient, with the other 41 indicators, at least 50 per cent higher than that needed for it to be statistically significant at the 1 per cent level; that is, the ratio between the average correlation and the level that would be significant had to be 1.5 or more. This tended to eliminate indicators with fairly good correlations but with comparatively poor coverage of countries.

Secondly, the indicator had to have a correlation coefficient of 0.60 or more individually with at least 21(half) of the indicators in the reservoir. (In all cases, the average correlation with the totality of indicators in the reservoir was 0.60 or more).

Thirdly, the indicator could not have a correlation coefficient greater than 0.90 with any other indicator in the reservoir which could be considered to overlap with it by definition.

Finally, the co-variation of the indicator with other indicators had to be sufficiently strong at the different levels of development to permit a best-fitting curve to be reasonably drawn in scatter-diagrams. (The criterion of a minimum correlation for developed and developing countries separately was tried but had to be given up because results depended too much on the definition used of developed and developing countries).

24 of the 42 indicators in the reservoir qualified under the first criterion. Under the second criterion two of these indicators, namely motor vehicles per 1000 population and per capita caloric consumption got excluded. When the third criterion was applied, three more were eliminated, infant mortality rate, literacy and average size of private household. As between expectation of life and infant mortality,

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1/ These criteria were made even more stringent than first intended after experimentation with an original core of 24 variables (reported in Research Notes no.1) showed that some of those variables did not meet the practical requirements of analytic work, particularly in connexion with setting up the correspondence system - generally because there were too few observations or the correlations with other variables were too weak in a major bloc of countries.

which correlated 0.93, the former was chosen because it had a higher average correlation and a higher correlation-significance ratio (1.76) than that of infant mortality (1.69). As between the percentage of literates and the combined primary and secondary enrolment, which correlated 0.94, the latter had a higher average correlation-significance ratio (2.04) than the former (1.61). Between birthrate and average size of private households, which correlated 0.94 the correlation significance ratio was the same (1.67). Birthrate was preferable because of its greater simplicity and less ambiguity of meaning but it too had to be eliminated by the fourth criterion (average size of household would also have been eliminated by the fourth criterion).

The resulting core consists of 18 variables, nine social and nine economic; 13 are developmental and five structural. In Table 5 the core variables are underlined and the correlation matrix of the core variables (adjusted data)[1/] is presented in Table 6. The average correlation of each variable with the other core variables, given in Table 7, shows that these correlations are quite high, fourteen of the eighteen being 0.75 or more. When the data for the 18 core variables are mathematically transformed to take account of different patterns of distribution or change of the variables in relation to each other - the method of transformation is described in detail in Chapter VI - then the intercorrelations are substantially increased, as indicated in Table 8. This correlation matrix for adjusted and transformed data shows that each of the core variables has an average correlation with the 17 other variables of at least 0.80, ranging up to 0.90. Table 9 (adjusted data) separately groups social development indicators, economic development indicators and structural indicators, and shows that, in general, the averages of the internal correlations and of the cross-correlations are remarkably similar.

It is perhaps necessary to emphasize again the limitations of even the selected core indicators. Flaws of one kind or another can be noted in nearly every one of them, and some indicators that had to be rejected, usually because of lack of data, may well be better indicators than those included.

Life expectation, while the best of the health indicators, is nonetheless a complicated ("confounded") variable which, being based on deaths, does not necessarily reflect well the health or morbidity of those alive. Per cent of population in localities of 20,000 or over is plagued by definitional problems (some countries include agricultural surrounding areas, others omit obviously urban surrounding or contiguous areas in their definitions of localities 20,000 or over in population).

1/ See page 55.

Consumption of animal protein per capita, like all of the food indicators, is based not on observed and measured consumption, but on estimates derived from figures on agricultural production, exports and imports, presumed losses and wastage etc. Combined primary and secondary schools enrolment does not necessarily reflect attendance(or quality)of education. Vocational enrolment has serious definitional problems (should coresponcence courses be counted, or part-time training, or in-service training?). Average number of persons per room is a particularly defective indicator for cross-national comparisons, given the differences in climate and in living habits from region to region, and it would be well replaced by some other indicator such as percentage of houses with electricity, percentage of houses with water, proportion of the population living in permanent dwellings or without shelter, etc. - if sufficient data existed for these other indicators. Newspaper circulation does not reflect the size or contents of the newspapers or what they are read for (information, comics, racing results, etc.). Radio receivers per 1,000 population are measured by licences or by estimates of sets in use based on figures from production and sales, import and export, with assumed rate of discard. These different methods of computation do not necessarily yield comparable results, particularly if the recent sudden increase of cheap transistor sets is not covered by the licensing method (licences not being required) but is covered by the method of production and sales estimates. Furthermore, the inherent importance of radios may be questioned. Agricultural production per male agricultural worker in U.S. dollars is subject to all the difficulties of measuring (or estimating) such production, particularly in developing countries, as well as the difficulties of conversion to dollar values for international comparison. Energy consumption in terms of kilograms of coal equivalent per capita is an internationally computed aggregative or synthetic indicator which rests on relatively arbitrary but consequential decisions as to method of aggregation (should electricity be converted to coal in terms of the amount of coal required to generate a given amount of electricity, or in terms of the amount of coal and the amount of electricity required to generate the same amount of heat?). And so with other indicators.

The remarkable thing is that with all these deficiencies, the core indicators are so highly intercorrelated. There is no apparent reason why the known deficiencies should themselves be a cause of the high correlations. In fact, there is reason to believe that with better indicators, the correlations would be still higher.

While the selected set of core indicators is by no means the ideal set, it is the best that could be chosen out of the existing data for the type of cross-country analysis attempted here. With improved data the core indicators might be different from what they are here. But we do not believe that improved data would greatly change the methodology or upset the main conclusions to be drawn from the analysis presented in the next chapter.

Table 5: LIST OF INDICATORS - RESERVOIR

(core indicators have been underlined)

DEVELOPMENTAL	STRUCTURAL
Health and Demographic	
Infant mortality rate	Crude birth rate
Expectation of life at birth	Population in localities of 20,000 and over as per cent of total population
Death rate due to infectious and parasitic diseases, per 100,000 population	Average size of private households
Inhabitants per physician	Proportional mortality ratio
Inhabitants per hospital bed	
Nutrition	
Calorie consumption, per capita, per day	Consumption of calories derived from cereals and starchy roots as per cent of total calorie consumption
Protein consumption, per capita, per day	
Consumption of animal protein, per capita, per day	
Education	
Literate as per cent of total population (age group 15 and over)	Female, as per cent of total, primary enrolment
Combined primary and secondary enrolment as per cent of age group 5-19	
Vocational enrolment as per cent of age group 5-19	
Higher education enrolment per 1,000 aged 20-29	
Housing	
Average number of persons per room	
Dwellings with piped water as per cent of all dwellings	
Dwellings with electricity as per cent of all dwellings	
Communications	
Newspaper ('daily general interest') circulation per 1,000 population	
Telephones per 100,000 population	
Radio receivers per 1,000 population	

DEVELOPMENTAL	STRUCTURAL
Transport and Services	
Railway net-ton kilometres, per capita	Per cent of economically active population in electricity, gas, water, sanitary services, transport, storage and communications (ISIC division 5,7)
Passenger railway kilometres, per capita	
Motor vehicles per 1,000 population	
Agriculture	
Agricultural production per male agricultural worker (ISIC division 0), in 1960 U.S. dollars	Adult male labour in agriculture as per cent of total male labour (ISIC division 0)
Industry	
Electricity consumption, kwh. per capita	GDP derived from manufacturing as per cent of total GDP (ISIC division 2-3)
Steel consumption, kg. per capita	
Energy consumption, kg. of coal equivalent per capita	
Trade	
Foreign trade (sum of imports and exports) per capita, in 1960 U.S. dollars	Concentration of exports (exports of largest single item, in terms of single digit SITC code, as per cent of total exports)
	Exports of manufactures (SITC codes 5 to 8) as per cent of total exports
General	
Investment per economically active person, annual average 1950-1960 in 1960 U.S. dollars	Salaried and wage earners as per cent of total economically active population
	Total structural differential in production
	Private consumption expenditure as per cent of GNP
	Expenditure in food as per cent of total private consumption expenditure

Table 6: CORRELATION MATRIX OF THE CORE INDICATORS, ADJUSTED DATA, 1960*

Indicators	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	.629																	
3	.778	.775																
4	.841	.844	.814															
5	.724	.673	.714	.717														
6	.818	.691	.813	.866	.799													
7	.784	.804	.835	.827	.836	.769												
8	.623	.644	.797	.663	.768	.736	.846											
9	.612	.670	.758	.702	.813	.648	.850	.851										
10	.828	.658	.848	.758	.796	.800	.829	.706	.597									
11	.774	.776	.864	.848	.905	.817	.852	.880	.870	.774								
12	.853	.892	.821	.836	.813	.876	.845	.686	.654	.871	.875							
13	.557	.504	.664	.601	.729	.659	.732	.840	.722	.744	.698	.598						
14	.691	.609	.715	.733	.786	.691	.814	.775	.757	.657	.945	.810	.703					
15	.631	.705	.741	.715	.828	.681	.802	.819	.897	.642	.911	.699	.760	.874				
16	.782	.766	.788	.779	.800	.831	.824	.649	.623	.677	.811	.844	.552	.808	.667			
17	.683	.642	.728	.706	.837	.769	.839	.761	.585	.826	.770	.758	.714	.678	.661	.602		
18	.790	.849	.786	.735	.647	.834	.731	.667	.651	.832	.731	.833	.592	.723	.656	.728	.707	

INDICATORS IDENTIFICATION:

1 Expectation of life at birth
2 % Population in localities of 20,000 and over
3 Consumption of animal protein, per capita, per day
4 Combined primary and secondary enrolment
5 Vocational enrolment ratio
6 Average number of persons per room
7 Newspaper circulation per 1000 population
8 Telephones per 100,000 population
9 Radio receivers per 1,000 population
10 % E.A.P. in electricity, gas, water, etc.
11 Agricultural production per male agricultural worker
12 % Adult male labour in agriculture
13 Electricity consumption, Kwh. per capita
14 Steel consumption, Kg, per capita
15 Energy consumption, Kg of coal equiv. per capita
16 % GDP derived from manufacturing
17 Foreign trade per capita, in 1960 U.S. dollars
18 % Salaried and wage earners to total E.A.P.

*Negative signs omitted in correlations of Indicators 6 and 12.
The countries vary from coefficient to coefficient.

Table 7

AVERAGE CORRELATION OF EACH CORE INDICATOR
WITH ALL OTHER CORE INDICATORS
ADJUSTED DATA, 1960.

	Indicator	Average Correlation
1	Expectation of life at birth	.744
2	% Population in localities of 20,000 and over	.730
3	Consumption of animal protein, per capita, per day	.791
4	Combined primary and secondary enrolment	.777
5	Vocational enrolment ratio	.788
6	Average number of persons per room	.783
7	Newspaper circulation per 1000 population	.823
8	Telephones per 100,000 population	.762
9	Radio receivers per 1000 population	.737
10	% E.A.P. in electricity, gas, water, etc.	.769
11	Agricultural production per male agricultural worker	.839
12	% Adult male labour in agriculture	.809
13	Electricity consumption, Kwh. per capita	.687
14	Steel consumption, Kg, per capita	.765
15	Energy consumption, Kg. of coal equiv. per capita	.760
16	% GDP derived from manufacturing	.752
17	Foreign trade per capita, in 1960 US dollars	.737
18	% Salaried and wage earners to total E.A.P.	.750

Table 8: CORRELATION MATRIX OF THE CORE INDICATORS ADJUSTED AND TRANSFORMED DATA 1960*

Indicators	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1																	
2	.654																
3	.820	.755															
4	.866	.828	.823														
5	.848	.851	.798	.888													
6	.814	.713	.820	.866	.820												
7	.906	.841	.849	.912	.857	.803											
8	.905	.884	.886	.864	.891	.902	.924										
9	.765	.788	.772	.815	.866	.737	.882	.890									
10	.850	.592	.848	.758	.786	.800	.866	.865	.697								
11	.911	.812	.929	.902	.838	.876	.908	.923	.851	.867							
12	.861	.889	.830	.836	.820	.876	.899	.908	.728	.871	.930						
13	.844	.870	.840	.901	.895	.881	.916	.944	.851	.868	.893	.885					
14	.863	.728	.829	.830	.813	.809	.881	.916	.760	.811	.945	.904	.940				
15	.871	.901	.808	.884	.869	.805	.902	.933	.870	.817	.895	.873	.955	.936			
16	.791	.770	.788	.794	.791	.650	.843	.831	.724	.668	.880	.835	.867	.870	.823		
17	.826	.800	.788	.756	.716	.839	.854	.883	.743	.841	.866	.845	.836	.818	.832	.646	
18	.783	.849	.831	.745	.726	.843	.808	.886	.790	.847	.845	.851	.839	.861	.805	.747	.828
AVERAGE	.843	.807	.834	.848	.837	.836	.881	.902	.807	.814	.893	.869	.890	.862	.877	.807	.818

INDICATORS IDENTIFICATION:

1 Expectation of life at birth
2 % Population in localities of 20,000 and over
3 Consumption of animal protein, per capita, per day
4 Combined primary and secondary enrolment
5 Vocational enrolment ratio
6 Average number of persons per room
7 Newspaper circulation per 1000 population
8 Telephones per 10,000 population
9 Radio receivers per 1,000 population
10 % E.A.P. in electricity, gas, water, etc.
11 Agricultural production per male agricultural worker
12 % Adult male labour in agriculture
13 Electricity consumption, Kwh. per capita
14 Steel consumption, Kg. per capita
15 Energy consumption, Kg. of coal equiv. per capita
16 % GDP derived from manufacturing
17 Foreign trade per capita, in 1960 U.S. dollars
18 % Salaried and wage earners to total E.A.P.

*Negative signs omitted in correlations of indicators 6 and 12. The countries vary from coefficient to coefficient.

Table 9

AVERAGES OF CROSS CORRELATIONS FOR SOCIAL ECONOMIC, AND STRUCTURAL CORE INDICATORS ADJUSTED DATA (1960)

	Social	Economic	Structural
Social	.772		
Economic	.757	.771	
Structural	.755	.699	.795

Chapter V

THE CORRESPONDENCE SYSTEM

The isolation of the core of high correlates is the first stage of the present analysis. We have now identified a manageable number of variables which tend to change as a group with development. In a statistical sense, given the available data, they may be said to define or identify socio-economic development, as a group. The next step is to examine the nature of the interrelations of these variables, as found in objective reality. It has been pointed out in Chapter I that our concern, in the present study, is not to specify causal relations or to set up any kind of input-output system among the variables. Nor is our present concern to establish an ideal system of interrelations among the variables, specifying the levels of each variable that should go with the levels of other variables in a perfectly balanced developmental process.[1/] Our concern is rather to ascertain if possible the quantities of the different variables that tend to go together at different levels - without saying why these quantities go together or whether they should go together - and thereby determine normal patterns of development.

The system of correspondence points used in this chapter is derived conceptually from work undertaken in the 1961 UN Report on the World Social Situation, and the following excerpt from that report is relevant to the present analysis:

"While it is theoretically not possible to state what levels of development in the various social components should go with given levels of economic development, it is quite possible to state what social levels do go with given economic levels - that is, to examine the patterns of development from a purely empirical point of view. It is conceivable that, in the light of some ideal model, the majority of the countries of the world would turn out to be unbalanced in the emphasis they give to the different social and economic fields. Certainly there are regional differences and differences along political lines. What is appropriate for one country will not necessarily be appropriate

---

1/ It should be noted that when cross-national data are used in correlation or regression analysis to set up presumed causal relations of one kind or another, the actuality may be implicitly converted into the ideal. The amount of increase in, say, education or health that empirically corresponds to a given increase of per capita GNP is viewed as a determinant or requirement for that increase of per capita GNP, and as such it constitutes the ideal increment of education or health if the per capita GNP is to be increased by the given amount.

for another. But after these cautions have been expressed and emphasized, the judgment can still be maintained that knowledge of the experiences and practices of other countries in regard to the interrelationship of economic and social development can be a useful type of information, particularly for those who must make practical decisions in countries that lack experience in development. Furthermore, the wider the range of experiences that can be examined, the better.[1/]

The Report backed this statement up by an attempt to determine statistically the levels of social development that corresponded empirically with given levels of economic development. The study was necessarily limited and it covered only four indicators of development (per capita GNP, energy consumption, infant mortality rate, primary and secondary school enrolment ratio). It sought to delineate the ranges, on the scales of these indicators, that empirically corresponded with each other. The present study uses many more indicators (and not the same technical definitions of common indicators), it has considerably wider data coverage, and employs a quite different method for establishing correspondences.

It is because of the high intercorrelations among the core indicators that it is possible to establish "correspondence points" or normal ratios between the indicators, at the different levels of development; that is, to determine, for example, what level of life expectation, or of school enrolment, etc. is normally associated with the $ 200 per capita national income level, the $ 300 level, the $ 400 level, etc. - or with given levels of any other indicator. These correspondences are rough and approximate - the expression "correspondence points" should not be taken to imply precision. Allowance must be made for error and variation, particularly at the extremes of the scales.

The correspondence points are determined in such a way as to be consistent in all directions. Thus, if 59 years of life expectation corresponds to a school enrolment ratio of 47, and a school enrolment ratio of 47 corresponds to a per capita GNP of $ 300, then $ 300 per capita and a school enrolment ratio of 47 will both correspond to 59 years of life expectation.[2/] Correspondences are not equivalences or exchange values - 59 years of life expectation is not equivalent to or worth $ 300, for example, or worth a school enrolment of 47; and an increase of life expectation by a given number of years cannot be said to have a value equal to the corresponding increment in per capita GNP, school enrolment, electricity consumption or other indicator.

1/ United Nations, Report on the World Social Situation, 1961. Page 39.

2/ This contrasts with "regression lines" two of which may be drawn for every pair of variables, A and B - one where B is assumed to be dependent on A, the other where A is assumed to be dependent on B. Consistency will not obtain with a series of variables related through regression lines.

The correspondence points are derived in principle from the best-fitting curve in a multi-dimensional scatter diagram involving all the indicators in question. However, as there is no general mathematical method by which the best-fitting curve can be defined even in two dimensions, not to speak of multi-dimensional space, more pedestrian methods had to be adopted to approximate the concept.

Two possible methods of determining correspondence points in practice were considered. The first was to prepare scatter diagrams from data on all possible pairs of indicators (19 indicators were involved, the 18 core indicators plus the per capita income, so that 171 scatter diagrams would be necessary), and try to arrive in each case at a curve best fitting the pattern of distribution (by use of moving averages or other methods). The corresponding values for all indicators could then be read off from these curves and reconciled with one another so as to make them consistent in all directions. The second method was to rank countries according to a conventional indicator of development, in particular the per capita income, divide them into successive groups (e.g. $ 100 to $ 199, $ 200 to $ 299,...) and then average the scores on all the indicators in each group.

Of these two methods, the second was not found to be workable or desirable. Because of gaps in the data, the information available on different indicators covered a varying number and varying sample of countries - that is, the countries whose scores were to be averaged were not the same on each indicator. An attempt at reduction to a common core of countries having data on all 19 variables would end up with four countries. Furthermore, the per capita income or other indicator used as a master indicater for grouping the countries would have more than warranted influence on the correspondence points emerging from such calculations.

The method of scatter diagrams was therefore chosen. But a method involving the setting up of best-fitting curves in 171 separate scatter diagrams and working out the mutual adjustments of all the results was quite impracticable. A short-cut method had to be employed. This was to choose four indicators and to establish in elaborate detail the correspondence points among these four in the first instance. At the next stage, correspondence points for the remaining indicators in the core were worked out with reference to these four rather than with reference to all. Tests indicated that this procedure yielded reasonably good best-fitting curves.

In this method, the incompleteness of the data still raised certain problems, particularly with regard to comparatively bare spots in the progression on the scatter diagrams. The best-fitting curves were therefore designed to reflect what would be the corresponding scores of given indicators at certain levels according to the best estimate

of what would be found if fuller data were available. This estimate was based not only on the available data in the sparse area but also on the shape of the curve above and below the area. The correspondence points as determined in this analysis therefore do not necessarily reflect what is but rather what presumably would be if fuller data were available.

The four indicators used for this operation were (1) proportion of male agricultural labour to the total male labour force; (2) the ratio of primary and secondary enrolment to population aged 5-19 years; (3) expectation of life at birth; (4) the per capita gross national product. The first was chosen as the structural indicator which had the highest average correlation with the total number of indicators in the Data Bank. The expectation of life and combined primary and secondary enrolment ratio represented two important social components of development (school enrolment proved not altogether satisfactory, however, because of scatter at the lowest levels). The per capita income was chosen, from outside the reservoir, as the economic indicator par excellence (size of agricultural labour force was, of course, also classified as an economic indicator).

Scatter diagrams for all possible pairs of these four indicators (6 in all) were prepared. Several methods were used for getting to the best-fitting curves. The most important was the method of "moving averages" - although this has certain limitations. It consists of ranking the values of each pair of indicators, averaging the bottom 5 values in each series, then moving up one step by dropping the bottom value and adding one new value, averaging again, and so on at every step. The same analysis was also carried out after elimination of countries in a given pair of indicators whose scores were substantially out of line in the rank orders (showing a difference of more than 5 in the two rank orders). On the scatter diagrams the moving average values realised from the two methods of calculation were plotted. Their slight range of variation provided in effect limits within which the final correspondence points were generally chosen.

Instead of trying to work out the final correspondences for every point up and down the scale, it was decided to concentrate on ten levels. For convenience, in the case of non-adjusted data, the correspondences at $ 100 intervals up to $ 500 and at $ 200 intervals thereafter on the per capita income scale were used for this purpose, and the moving average values mentioned above were examined with regard to those points on the four indicators. Essentially the same procedure was repeated with indicators adjusted for age structure.

The values obtained at each of the ten levels (by either method of moving average) were not fully consistent with one another, although the inconsistencies were not large[1]

Slightly different correspondences were found when different indicators were used as reference indicators. That is, if for a given value of life expectation, school enrolment and per cent of male labour in agriculture were read off, and if the value found for the per cent of male labour in agriculture was then used as a reference point to read off school enrolment, then the two school enrolment figures would not be exactly the same but might differ by one or two percentage points (not more).

These deviations, together with the deviations from the two methods of moving average described above (complete vs. selective data) furnished the range within which accommodations were made in deciding the best-fitting curves ensuring consistency in all directions. By a process of experimentation and rationalization (including some smoothing of curves) the correspondence points at the ten levels were selected and the best-fitting curves consistent in all directions for the four indicators were established (as a series of straight lines between the ten points). Some projection was necessary at the two extremes. (The problem of the extremes will be discussed further in the next chapter.) The six scatter diagrams with the best-fitting curves thus evolved are set out in Charts 1-6. It should be noted that these are for adjusted data (adjusted to age-structure). In the case of the four indicators in question, adjustments affect directly only per capita GNP figures; with adjustment, the per capita GNP figures become somewhat higher, with proportionally greater increases at lower income levels where children are relatively numerous, since children are given lower weighting in the adjustment than adults.

Inspection of the best-fitting curves of the six charts will show that the curves are consistent. Thus, 65 years of life expectation on Chart 1 corresponds to $ 650 (adjusted) per capita GNP: $ 650 on Chart 2 corresponds to 59 per cent school enrolment; 59 per cent school enrolment on Chart 4 corresponds to 65 years of life expectation.

The best fitting curves so obtained defining correspondences between the four indicators then became the basic frame of reference for working out the correspondence values in respect of the remaining 15 indicators.

By means of moving averages (using complete data) preliminary correspondences were established between each of the four indicators and each of the remaining fifteen indicators (at the 10 levels mentioned above). However, for each of the four operant indicators, at a given level of correspondence among the four, there might be a somewhat different corresponding value for any given indicator from among the remaining 15. Thus, while 59 years of life expectation corresponded to 47 per cent school enrolment in the operant indicators, the correspondence value on, say, agricultural

production per male agricultural worker might be somewhat different for 59 years of life expectation than for 47 per cent school enrolment. This problem was solved by averaging the four preliminary correspondence scores at each of the ten levels for each of the 15 indicators. A limited amount of reconciliation and rationalization was also carried out. A sample check was made which showed that the resulting correspondences, while not completely consistent in all directions, were not very far from it. Similar checks showed that best-fitting curves derived in this indirect manner between pairs of variables from the group of 15 were not unreasonably different from the curves derived from the more direct method.

Validation tests and Cross-temporal Comparisons

A test of the validity of the approach used in this study, including the indirect method of deriving best-fitting curves, may be cited. The best-fitting curve, indirectly derived, relating agricultural productivity and per capita (adjusted) animal protein consumption was examined in terms of the deviations of actual country scores from the curve (which is intended to represent the norm of interrelationships between these two variables). At the same time, the more commonly used "regression line" assuming dependency of animal protein consumption on agricultural productivity was derived and the deviations of actual country scores from this line were also computed. The indirectly derived best-fitting curve clearly gave a much closer approximation to the data. Even when a regression equation was evolved that took account of the curvilinear nature of the relationship between the variables, the indirectly derived best-fitting curve still provided a somewhat closer approximation to the actual data. Similar results were found with other pairs of variables.

This particular example has been cited for the reason that animal protein consumption in a country would seem to be manifestly dependent on agricultural productivity whereas agricultural productivity would seem less dependent on animal protein consumption - and the regression line assuming that dependency is in fact even farther from the actual data.) Yet the regression line is inferior to the indirectly derived best-fitting curve, presumably because the correlation between agricultural productivity and animal protein consumption is due only partly to the dependency of the latter on the former. The two variables are indirectly related as well as directly, and there is no doubt some influence of protein consumption on agricultural productivity, so that an analysis that assumes a simple one-way dependency will not do full justice to the data.

A second validation was a prediction test. Two variables were used in this test, school enrolment and percentage of male labour force in agriculture, which have similar

distribution, a fair number (45) of countries with data on both, and a high (negative) correlation (minus .84 for adjusted data). If every third country having data on both of these variables is arbitrarily dropped out, then two regression lines can be calculated for the remaining 30 countries and these regressions can be used for predicting the missing (but known) scores of the 15 countries. Thus for the regression of male agricultural labour on education, the education scores of the 15 countries can be used to predict their agricultural labour force scores on the basis of the relevant regression formula derived from the 30 countries. The amount of deviation from the actual score can be measured in each case. A corresponding procedure can be used for the regression of education on agricultural labour force. Finally, a best-fitting curve, which shows the levels of these two indicators that tend to go together but which does not assume dependency in any particular direction, can be established according to the methods employed in this study and it also can be used in predicting missing scores. The results show that neither regression line provides a very satisfactory prediction of missing scores, while the best-fitting curve provides a substantially better basis for prediction - the errors are significantly smaller (about 50 per cent smaller).

In other words, in this test an approach that analyzes <u>how</u> a given group of countries behaves with regard to particular variables provides a better basis for predicting how other countries will behave than does an approach involving assumptions as to <u>why</u> the original sample of countries shows a high correlation between the variables.

A third validation test was directed to two questions: will the correspondences remain the same if the sample of countries is different, and a different period of time is used? The correspondences of 1960 can be compared with those of 1950, when the sample of countries having data is smaller, and with those of 1965, when the sample of countries having data is usually different and often larger.

The 1950 data are so weak, however, that relevant best-fitting curves generally cannot be drawn with much confidence. (Also, in some cases, definitions or methods of statistical computation appear to have changed). Charts 7-9 show best-fitting curves derived from 1960 data superimposed on 1950 data for several pairs of indicators (unadjusted data). It is clear from visual inspection that the differences do not appear to be very great in most cases - that is, the 1960 curves tend to conform to the 1950 data. The major exception appears to be education which has shifted upwards.

for the same level of per capita GNP, school enrolment levels appear to be higher in 1960 than in 1950, particularly in developing countries.[1/] This may reflect an increasing share of the GNP invested in education, or it may reflect the fact that the developing countries having relevant data in 1960 but not in 1950 were relatively high in education. Analysis using the same countries for 1950 and 1960 indicates that the difference in sample plays a role but there is also a change in the comparative positi of education, independent of change in sample.[2/]

A somewhat different approach has been used for 1965 data. For several pairs of indicators, indirectly derived best-fitting curves for 1960 data (unadjusted) have been superimposed on the 1965 data, and at the same time, best-fitting curves for the 1965 data have been drawn directly for each pair of variables in question by means of the moving average method. (Charts 10-12). Differences between the two curves shown on these charts might be caused by:

1. Time change from 1960 to 1965
2. The different sample of countries in 1965
3. The complicated indirect method of derivation employed in 1960 vs. the best-fitting curves directly derived between two variables in 1965.

In spite of these possibilities of differences in the two curves, they are in general quite similar. The relation between energy consumption and animal protein consumption is almost exactly the same (the 1960 curve, indirectly derived, relates to a sample of 65 countries, the 1965 directly derived curve is based on a sample of 57 countries, of which 52 overlapped with the 1960 sample.) The two curves relating telephones and steel consumption are almost identical except at the highest level where there is a considerable scatter in the data (the indirectly derived best-fitting curve for 1960 relates to a sample of 54 countries, the 1965 directly-derived curve is based on a sample of 64 countries of which 54 overlapped with the 1960 countries). The curve

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1/ The same upward shift of school enrolment in developing countries between 1950 and 1960 is suggested in scatter diagrams relating enrolment to percentage of male labour in agriculture and to other variables but the data are too scarce to be conclusive.

2/ Whether this is a real change or a change in computation of school enrolment ratios, however, remains uncertain. UNESCO has warned that available school enrolment ratios are not comparable over time (in the same countries) and is attempting to work out a comparable time series. See UNESCO, Statistical Yearbook, 1968, page 35.

relating education to electricity (Chart 12) shows somewhat more difference, particularly for the developing countries - as in the 1950-1960 comparisons. (The indirectly derived 1960 curve relates to a sample of 93 countries, the 1965 curve to a sample of 86 countries, of which 75 overlapped.) A test carried out on the relation of education to animal protein consumption shows a similar displacement of education upward. As indicated above, however, the explanation for this upward displacement of education is not entirely clear as yet - it may be to some extent a statistical artifact resulting, for example, from non-comparable estimates of age-structure in developing countries at different periods of time.[1/]

The Correspondence Charts

We return now to the main argument. Charts 13 and 14 show the correspondences of the 19 indicators, determined according to the methods described in the preceding pages. Chart 13 is for non-adjusted data, Chart 14 for adjusted data.[2/] The lines shown in the Charts connect the correspondence points.

The broad picture presented by the correspondence chart is as it were a still-photograph of the countries in the world as they move in respect of the 19 indicators as a whole in 1960. There is no implication in the chart that the level of attainment on one indicator, say on combined and primary enrolment, is a requirement for the attainment of the corresponding level on another (e.g., per capita steel consumption or per capita energy consumption). It would be also prudent at this stage to emphasize again that the correspondence lines do not necessarily represent a historical sequence or a sequence of stages followed by countries moving forward on the path of development. While certain broad inferences can be drawn, it would be unwarranted to draw specific inferences about movements over time, and especially about the course of development of individual countries.

Within the general limitations specified above, the correspondence chart can provide certain theoretical and practical indications. The correspondence line, shown thicker than others and passing through $ 500 per capita income in Chart 13 and $ 550 in Chart 14, has been drawn to distinguish roughly between the developed and developing

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1/ A part of the difference between the 1960 and 1965 curves in Chart 12 is apparently due to the fact that the 1960 education curves tend to approximate lines given by the selective method of moving averages while the non-selective method of moving averages was used for the 1965 line.

2/ There are slight discrepancies in correspondences between figures in the two charts, owing to separate derivation, in addition to the major differences due to the use of adjusted vs. original figures. Only the adjusted figures are used for subsequent analysis.

countries. The indicators have been deliberately arranged so that the lines generally slope from left to right. It can be seen that the social and structural indicators are primarily on the left-hand side, the economic development indicators on the right-hand side. The two social indicators found on the right with the economic development indicators - vocational enrolment and telephones - are perhaps among the less social of the social indicators. All five structural indicators, and particularly the three indicators of labour force structure, are to be found considerably to the left of the per capita GNP.

In other words, the correspondence charts show that, in developing countries, the differentials between countries in the social and structural variables are comparatively much greater than in the economic variables. In the developed countries, the opposite is true. Thus, for countries between $ 74 and $ 1500 per capita GNP (unadjusted data), by far the greater part of improvement in health (80 per cent of it) as measured by life expectation rate, takes place by $ 500 per capita national income while only a small part of the differential between low-income and high-income countries in energy, electricity or steel usage is achieved by the $ 500 per capita level. Above the $ 500 level, health improvements are relatively small while industrial production indicators show large increments. In low-income countries an increase of $ 200 in per capita GNP (from $ 100 to $ 300) is associated with an increase of 14 years in life expectation but the same increase of $ 200 in high-income countries (from $ 1300 to $ 1500) is associated with an increase of only one year in life expectation.

While cross-temporal inferences from cross-national data are open to severe questioning, it would seem a reasonable surmise that different kinds of development factor grow at different rates at different levels; that at earlier stages of development the faster changing constituents of development are social and structural while at higher stages the economic indicators gain prominence as the faster growing constituents of development. In this connexion, it may be recalled that during the last two decades the rate of progress in mortality reduction and in primary and secondary education has been demonstrably quite rapid in the developing countries as compared to developed ones, whereas this has not been the case in economic growth-- a fact to which the periodic UN Reports on the World Social Situation have frequently drawn attention.

It must be emphasized that in any consideration here of temporal changes we are referring to long-term changes and general trends - not short-term changes in any single indicator or group of indicators, nor trends in any particular country.

The threshold of change

Examination of the best-fitting curves in the scatter-diagrams on which the correspondence charts are based suggests that around $ 400 to $ 500 per capita (unadjusted data) there is a threshold or point (or area) of change in the interrelations of indicators, where social and structural indicators, on the one hand, tend to slow down while economic development indicators, on the other hand, speed up. As shown by the scatter diagrams (and by the correspondence chart) the relation between social, or structural, and economic development indicators is usually curvilinear, and at about the $ 400 to $ 500 per capita GNP (unadjusted) level (roughly $ 450 to $ 550 in adjusted terms) the bend of the curve is sharpest on the scatter diagrams (See charts 15-18), although different indicators show somewhat different points of maximum change in their interrelations. Even when mathematical transformations are carried out to take account of different types of data distribution (see below), some kind of break or change in relationships is noticeable around the $ 400-$ 500 level.[1/] It may be that this is as good a way as any of defining the border between developed and developing countries.

Uses of the correspondence system

The correspondence system provides a kind of standardized "profile" with which the actual socio-economic profile of a country can be compared to find out how the pattern of its development deviates from the normal[2/] Deviations from the normal are of course

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1/ There is evidence suggesting that this is also roughly the area where demographic variables concerned with fertility and population structure undergo rapid change. It should be noted that the threshold or transition area is only very roughly indicated by the per capita GNP; in some countries the level of the per capita GNP poorly reflects even the level of economic development, as discussed above, and it is presumably the real level of total development that counts here, not the per capita GNP. Nevertheless, Chart 19 plotting crude birth rate against per capita GNP is quite revealing. It shows that if a best-fitting curve should be drawn between income and birth rate, it would bend most at about $ 400-$ 500 per capita. Only one country (Chile) with a crude birth rate more than 35 has a per capita GNP above $ 500, only two countries (Spain and Portugal) with crude birth rate below 27 have a per capita GNP less than $ 400. There are no countries in the sample with birth rates between 27 and 35.

2/ Standardized age-height-weight charts for children are extensively and effectively used in a number of developing countries as an aid to diagnosis of possible medical or nutritional problems.

to be expected, since each country is unique in its circumstances, and, as will be discussed later, certain typological differences (e.g., in country size) may imply differences in development pattern. But serious deviations may call for special study, which can reveal a good reason for them or can suggest a lagging sector or a sector of over-investment. This type of analysis may thus serve as an aid to diagnosis and a means of helping countries to evaluate their pattern of development - in terms of individual needs and potentialities rather than universalistic prescriptions or priorities. Instead of comparison with the normal or standard pattern, it may be eventually possible to make a comparison of a country's development pattern with the pattern of the fast growing countries.[1/]

It facilitates the use of the correspondence system as an aid to diagnosis and to evaluation of development pattern if the lines in Chart 14 are flattened by mathematical transformations.[2/] The resulting transformed correspondence system is given in Chart 25. Country scores on the different variables can be laid out on this chart and the country's profile becomes readily apparent. Charts 20 to 23 show the 1960 development profiles of several countries.[3/]

In Ireland (Chart 20) it can be seen that the social indicators are relatively high, except that vocational education is comparatively low (the Government has since 1960 introduced an extensive programme to expand vocational and technical training). At the same time the chart suggests that Ireland in 1960 was notably lagging in urbanization and industrialization. Employment was unusually high in agriculture but the labour force was relatively low in salaried workers and wage-earners. This picture is

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1/ This is under study.

2/ The method of transformation is described in the next chapter.

3/ The dotted line entitled "transformed correspondence index" represents a kind of weighted average of scores on the different indicators available (not including per capita GNP). It may be considered to be what the country's profile would look like if the country were completely "normal". This concept will also be explained in detail in the next chapter. In Charts 20-23, the indicators have been grouped so that the social come first, then the structural, finally the economic ending with the per capita GNP. Indicators with missing data have been omitted.

consistent with the large outmigration from Ireland of young people. The Government development programme has no doubt changed this picture.

Venezuela (Chart 21) shows several features quite the opposite of Ireland - relatively low social indicators (here also governmental action has changed the picture since 1960), but high levels on certain economic indicators associated with oil (energy consumption, trade, per capita GNP). Owing to reliance on oil extraction, however, manufacturing is quite limited.

It may be noted that the Venezuelan per capita GNP (adjusted) is considerably above the Irish per capita GNP. It is also, in fact, above the Netherlands per capita GNP (which appears quite low for that country's general level of development - see Chart 22). The Netherlands health level, on the other hand, is exceptionally high. The charts clearly show the limitations of the per capita GNP in dollar terms as a cross-national measure of development.

The correspondence system approach can serve to indicate to countries not only what their pattern of development is, compared with that of other countries at about the same general level of development, but also what pattern of development is normal at the next higher step of development - and therefore, in a sense, feasible, although typological and idiosyncratic features of the individual country must be taken into account. Thus, we can see what levels of health or education, for example, go with a higher level of economic production in fact; although it is not possible to say to what extent the health or education level may be a cause (or requirement) of the production level, or a consequence of it - or to say what the ideal relation should be.

In other words, correspondence analysis provides background facts that may be usefully considered in planning and projections, along with other facts about current needs, stresses and strains, bottlenecks, etc. Correspondence analysis is the more relevant if it is considered that targets for general social and economic factors should be set conjointly in terms of systems objectives, not simply as means and ends.

It may be objected that this approach, in so far as it relates social to economic factors on the basis of observed co-variation in a number of countries, would imply using as guidance for a given country the development patterns of other countries, which might not in fact apply, even if the other countries are generally similar. This is quite true. But it is better to have the experiences of other countries presented as in this way than to have the same basic data converted into mathematical functions or laws that appear to express universal objective truths about causal influences between social and

economic factors in development. In practice, the profiles of 1960 would appear to suggest areas of possible action (lagging sectors) which in a number of cases governments have in fact pursued since 1960.

The present report is intended as a methodological study, not as an immediate guide to development policy. The data are limited, better indicators are desirable, the typological factors have not yet been incorporated into the correspondence analysis, and the differences between fast and slow growing countries have not yet been adequately analyzed. As a methodological approach, the correspondence system is an attempt to devise a form of analysis that will adequately relate economic and social factors of development at the macro level, under the (now common) assumption that national development is both an economic and a social phenomenon - and given the fact that economic analytic models of an input-output type do not appear appropriate for representing the relationship between social and economic factors at the national level. The possibility of extending correspondence analysis to regions within countries - as by laying out the regions individually, as well as the country as a whole, upon Chart 25 - has yet to be explored.

A final use of the correspondence points system is in the building up of a unitary index of development out of the separate social and economic indicators. This process is described in the following chapter.

CHART 1

BEST FITTING CURVE – 1960 Data (Adjusted)

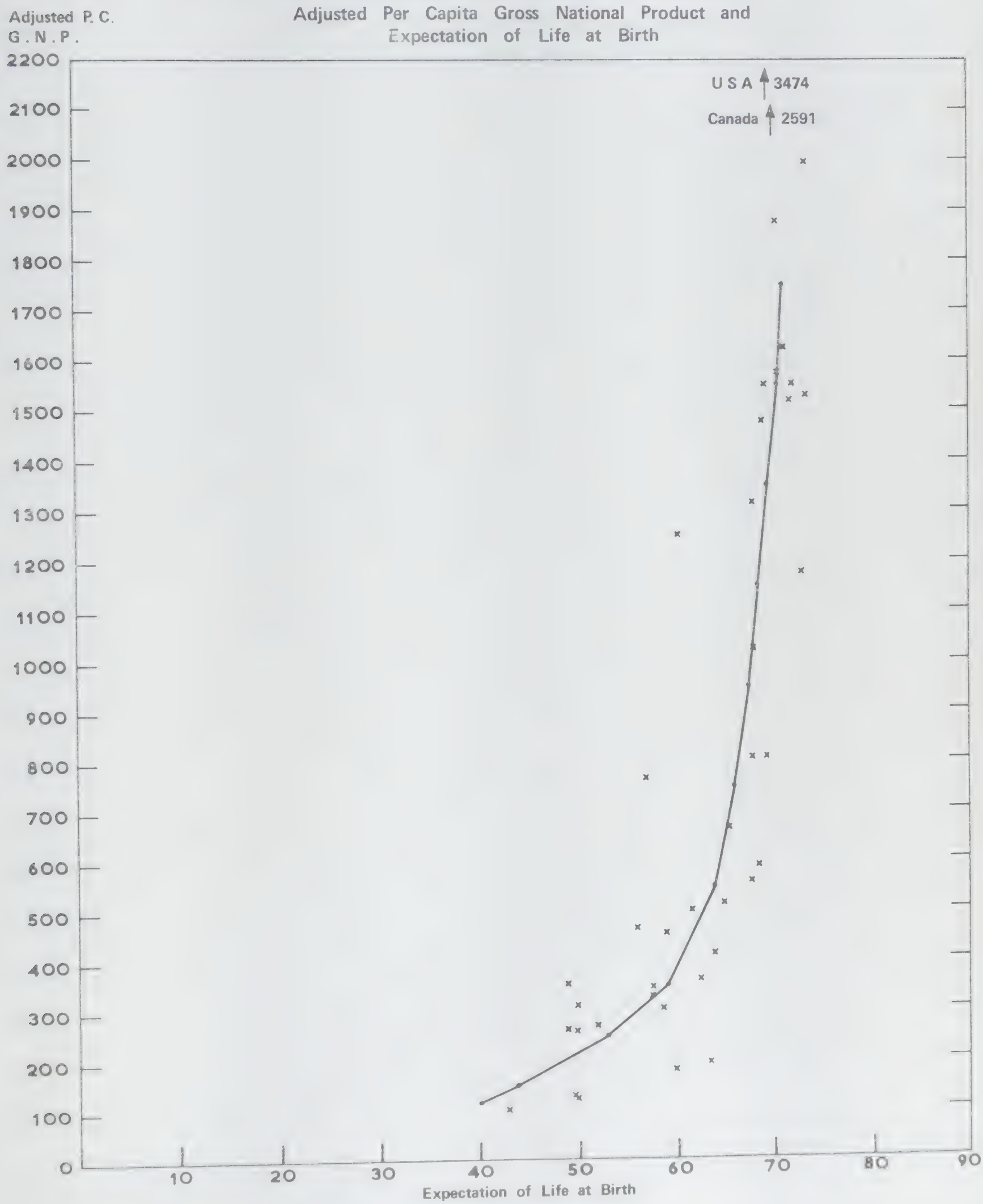


CHART 2

BEST FITTING CURVE – 1960 Data (Adjusted)

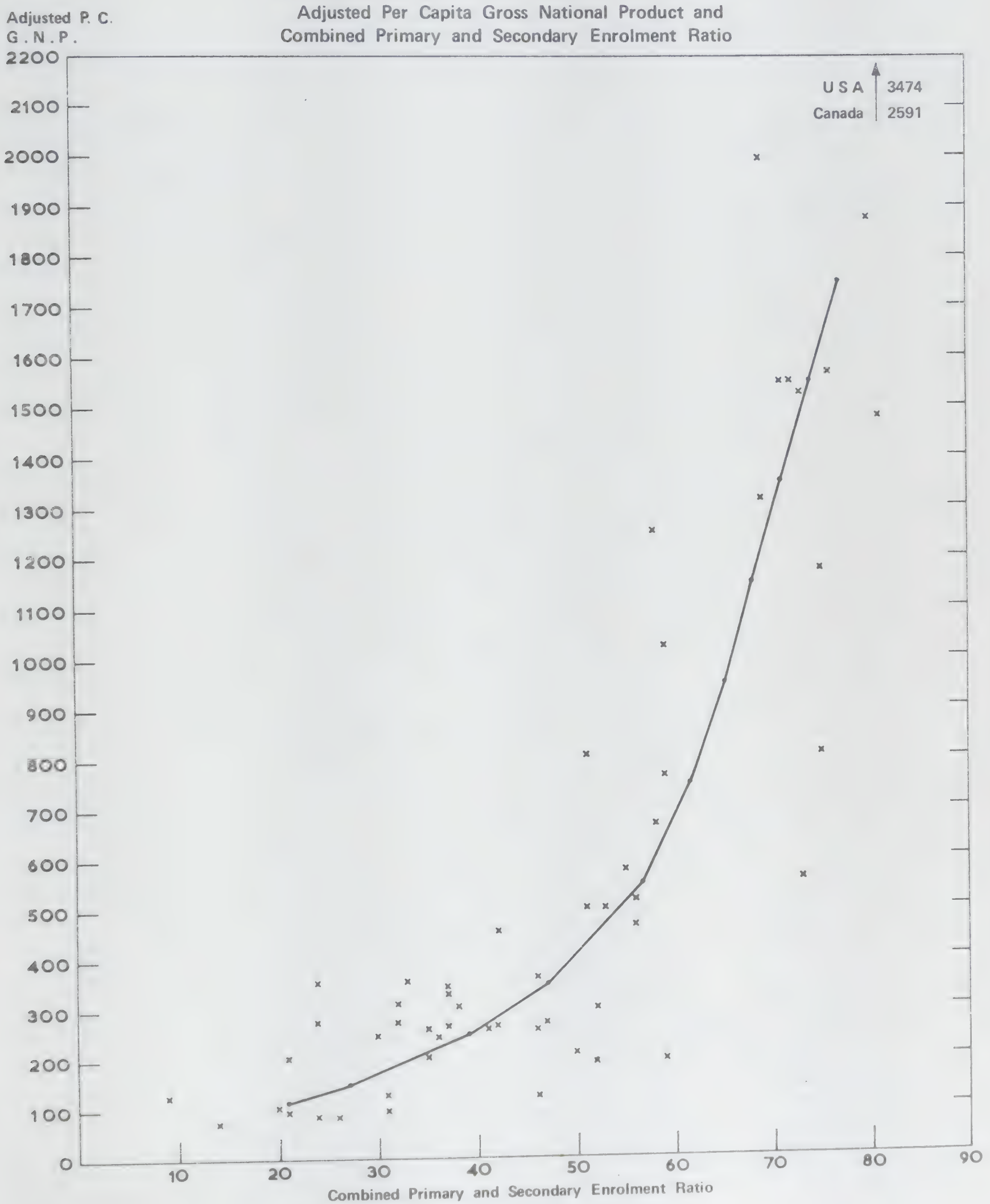


CHART 3

BEST FITTING CURVE – 1960 Data (Adjusted)

Adjusted Per Capita Gross National Product and
Per Cent Adult Male Labour in Agriculture

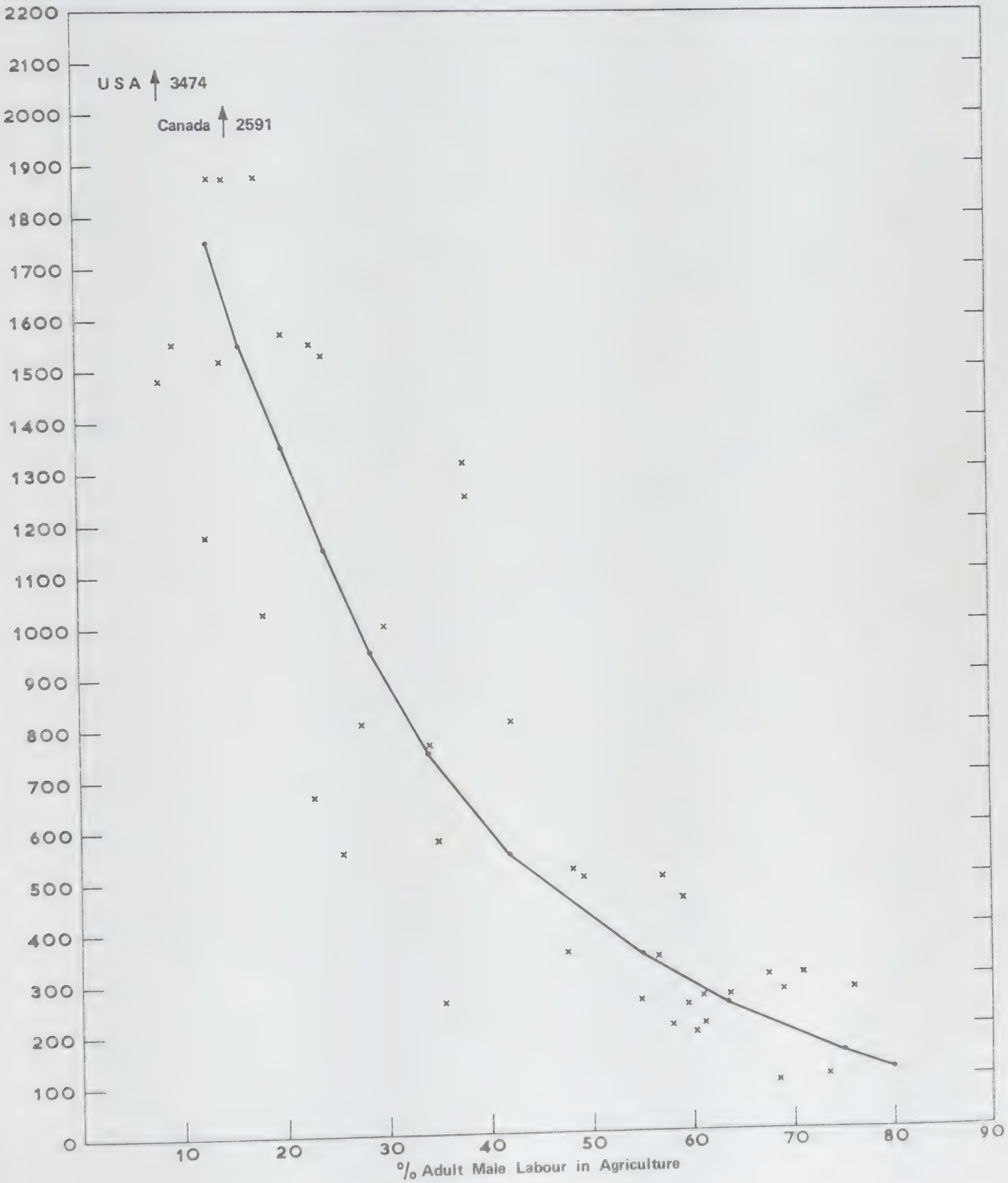


CHART 4

BEST FITTING CURVE – 1960 Data (Adjusted)

Expectation of Life at Birth and
Combined Primary and Secondary Enrolment Ratio

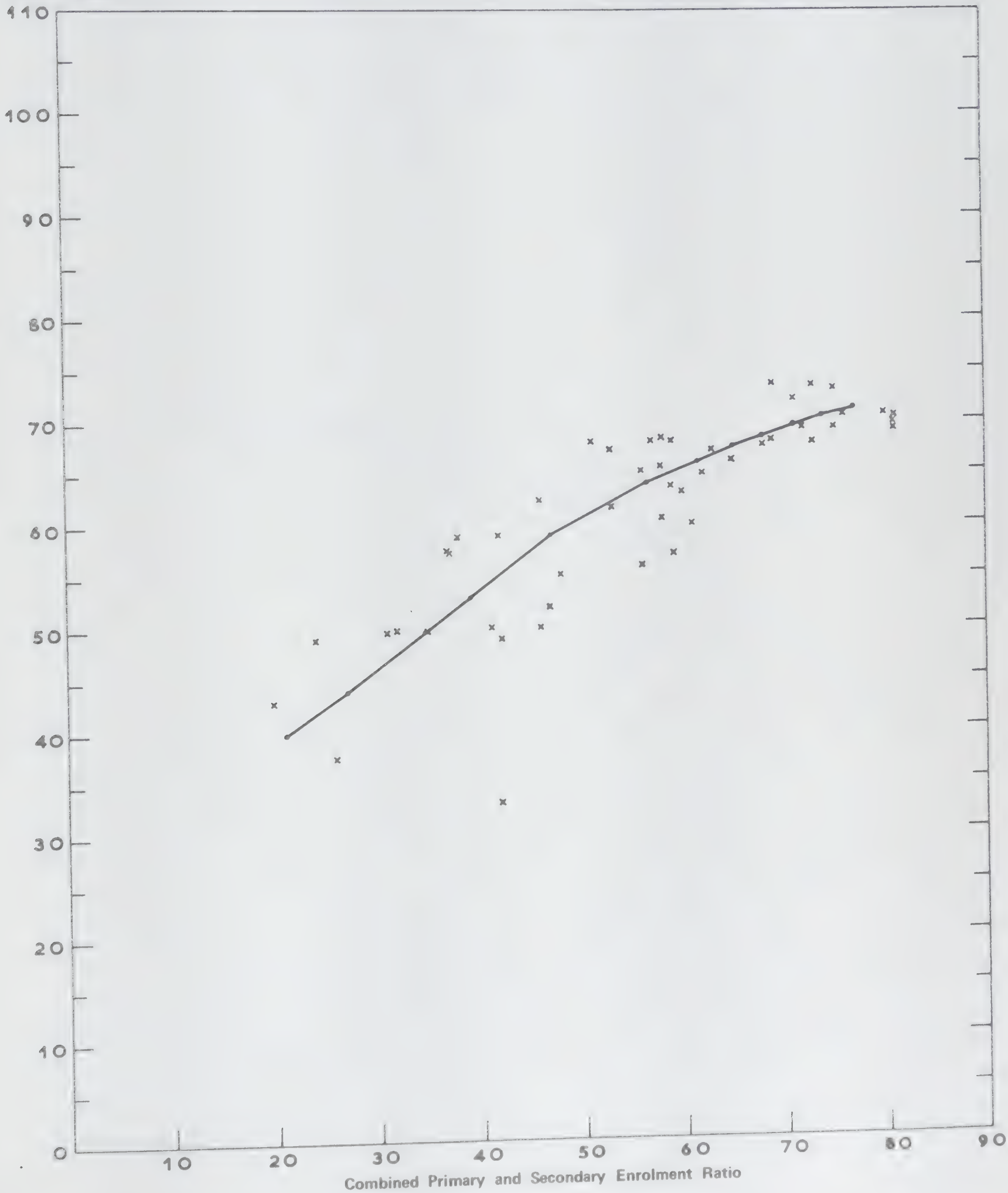


CHART 5

BEST FITTING CURVE – 1960 Data (Adjusted)

Expectation of Life at Birth and
Per Cent Adult Male Labour in Agriculture

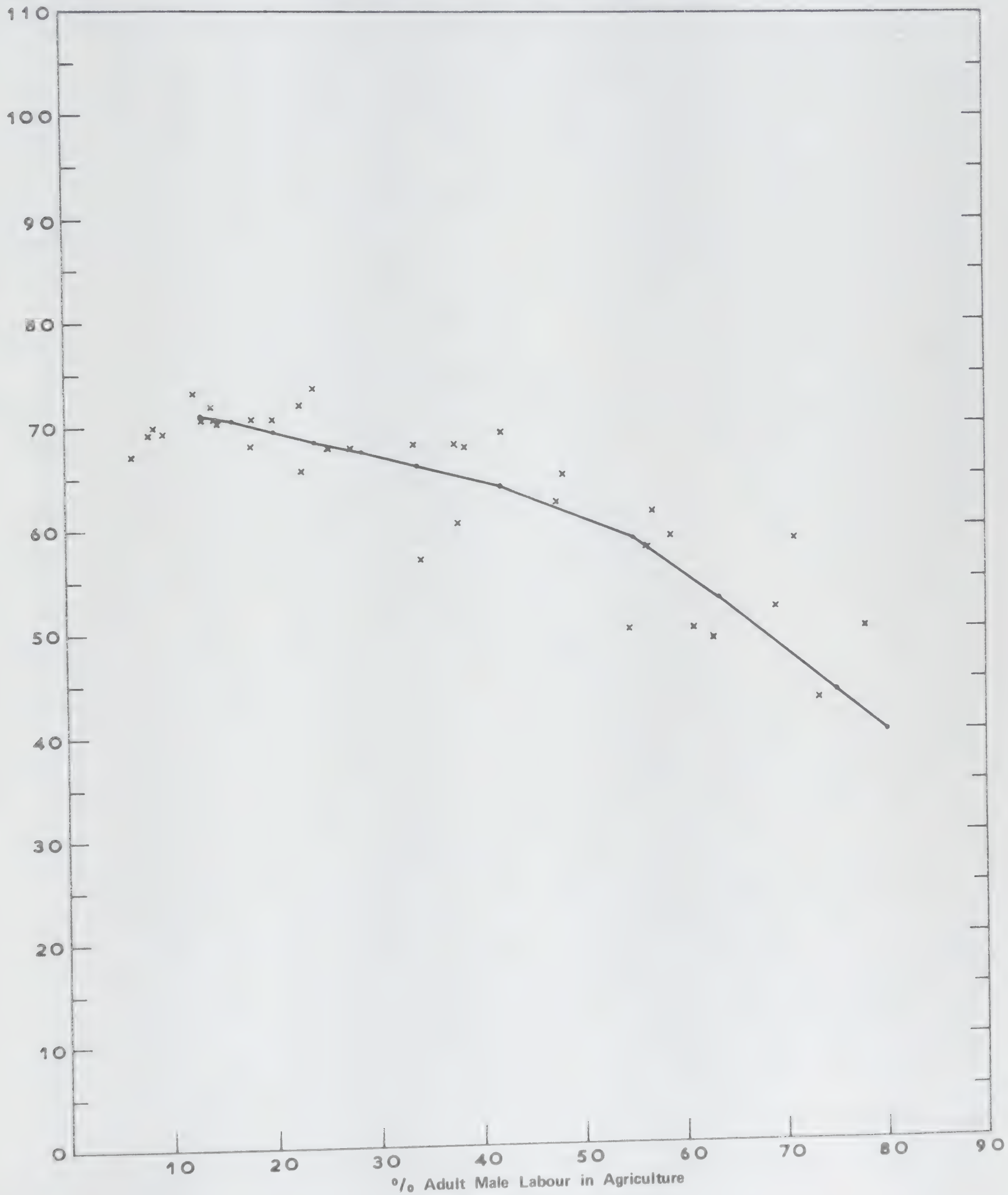


CHART 6

BEST FITTING CURVE – 1960 Data (Adjusted)

Per Cent Adult Male Labour in Agriculture and
Combined Primary and Secondary Enrolment Ratio.

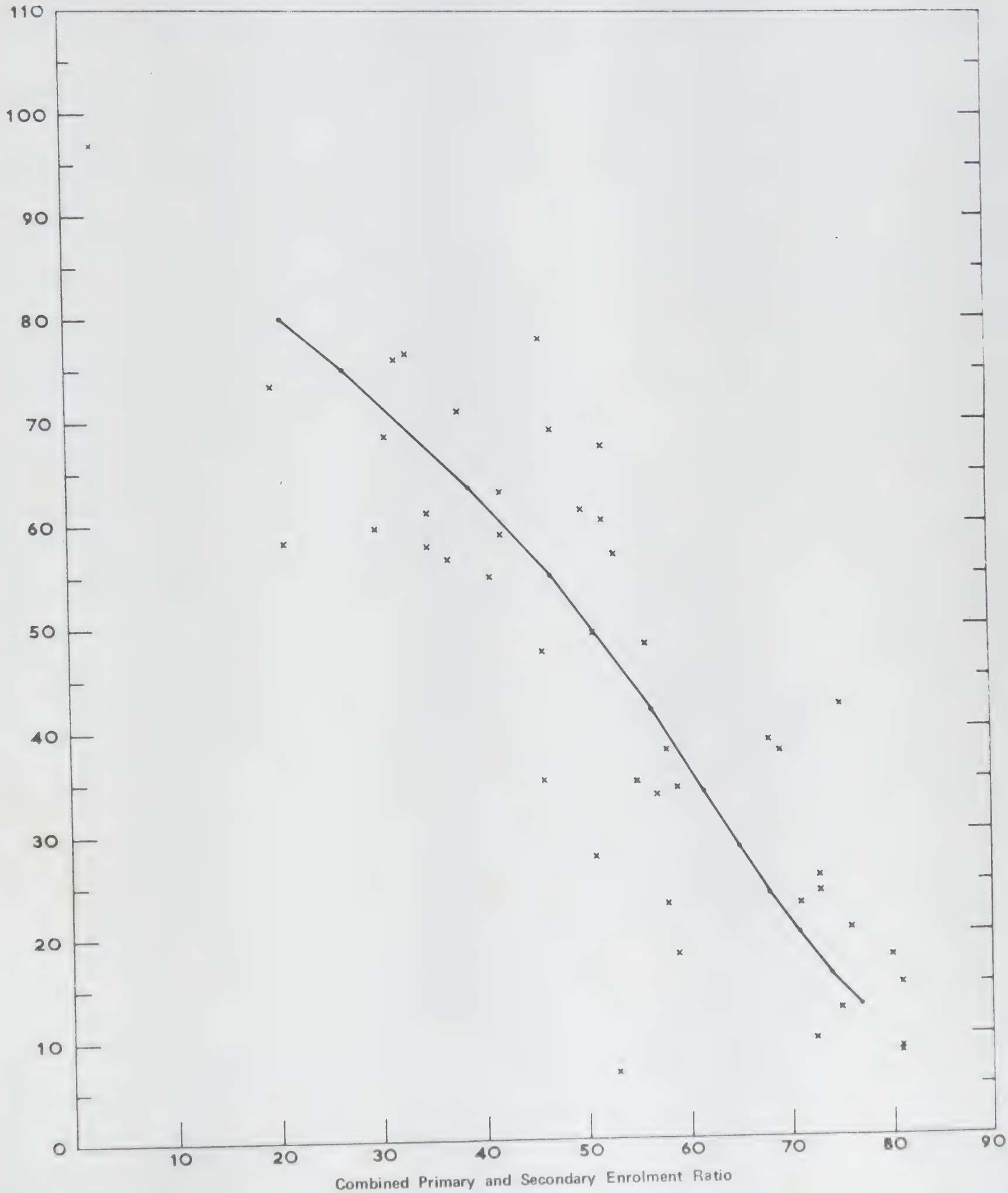


CHART 7

1960 BEST FITTING CURVE – 1950 Data (Original)

Per Capita Gross National Product and

Expectation of Life at Birth

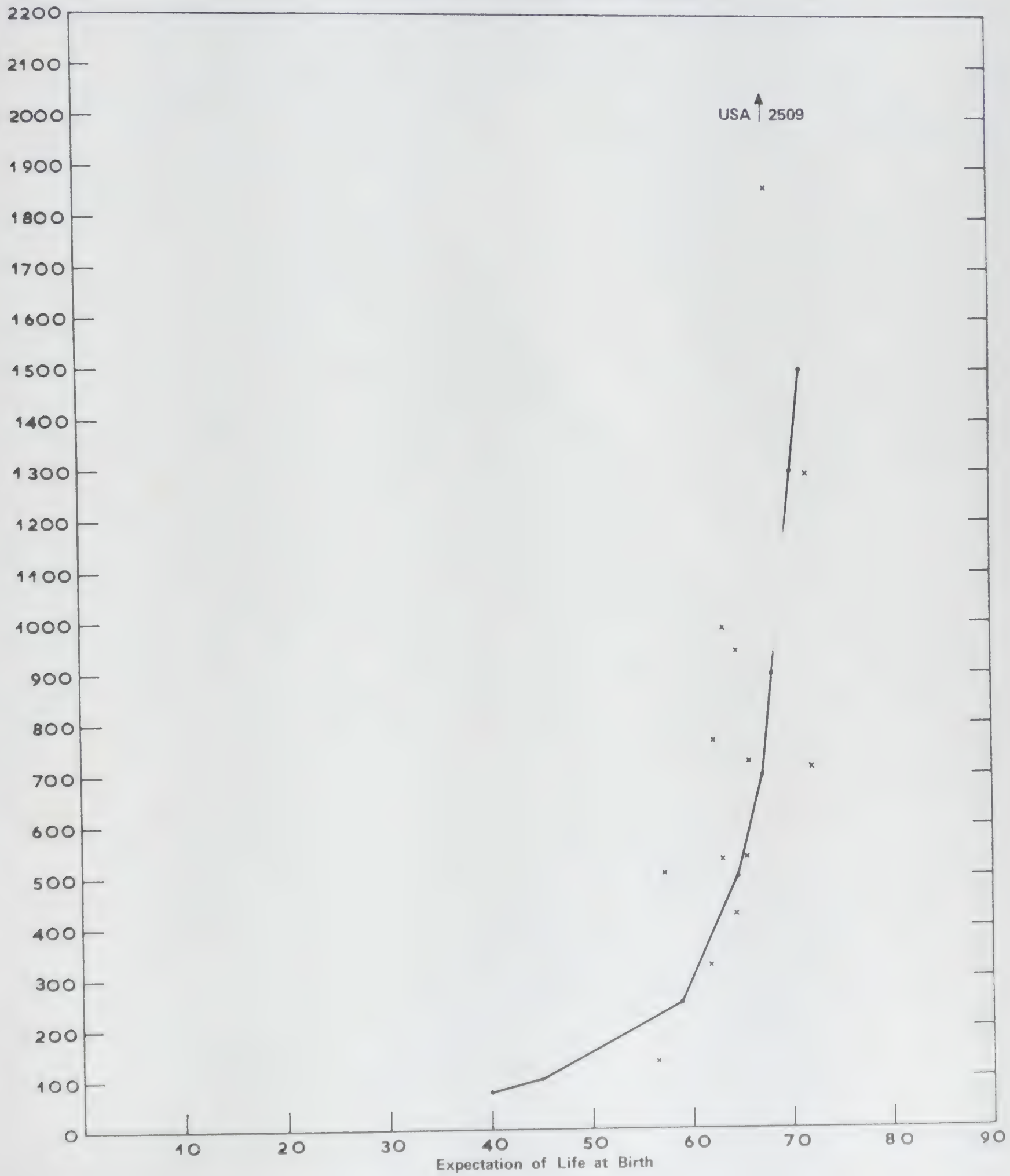


CHART 8

1960 BEST FITTING CURVE – 1950 Data (Original)

Per Capita Gross National Product and
Combined Primary and Secondary Enrolment Ratio

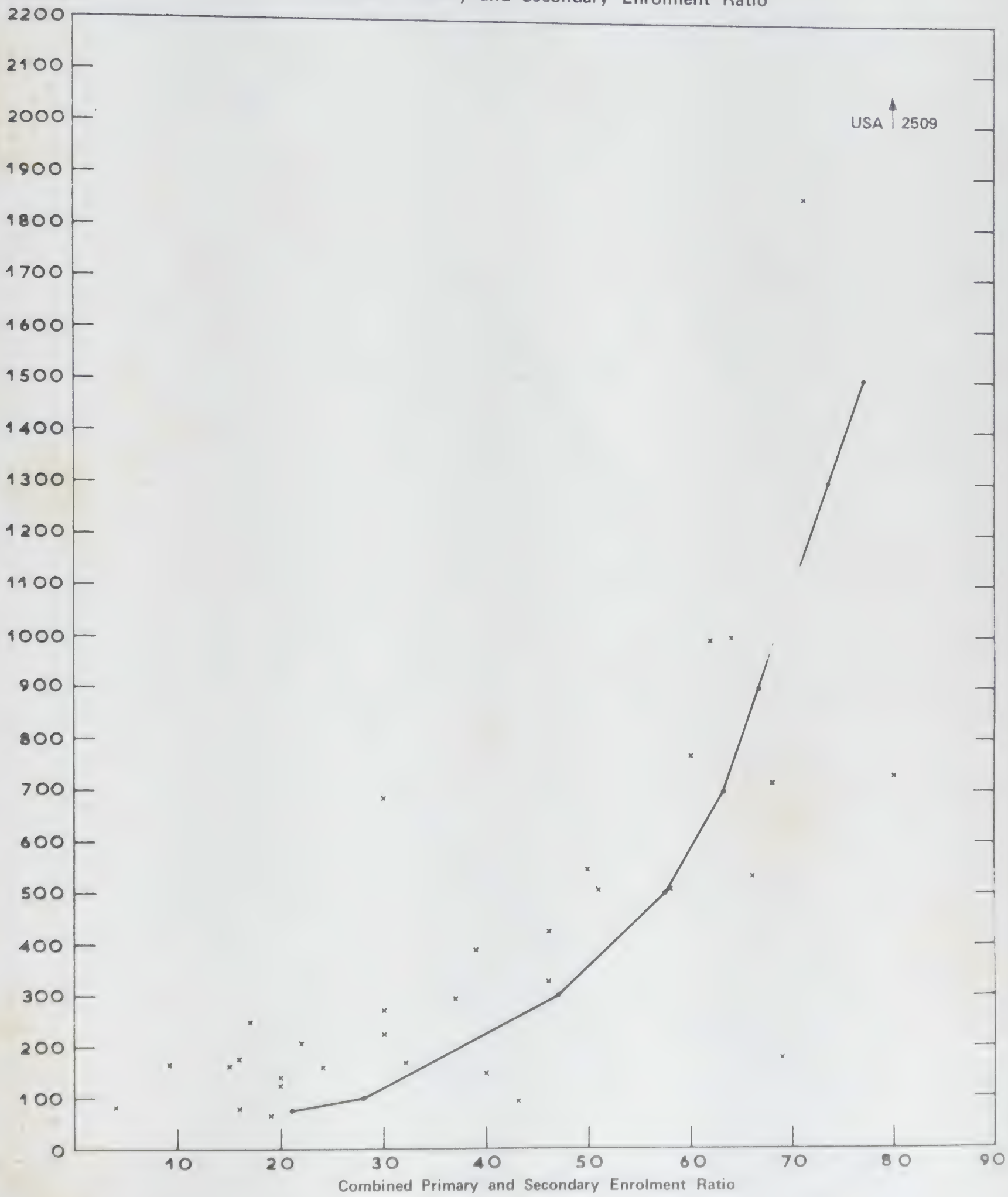
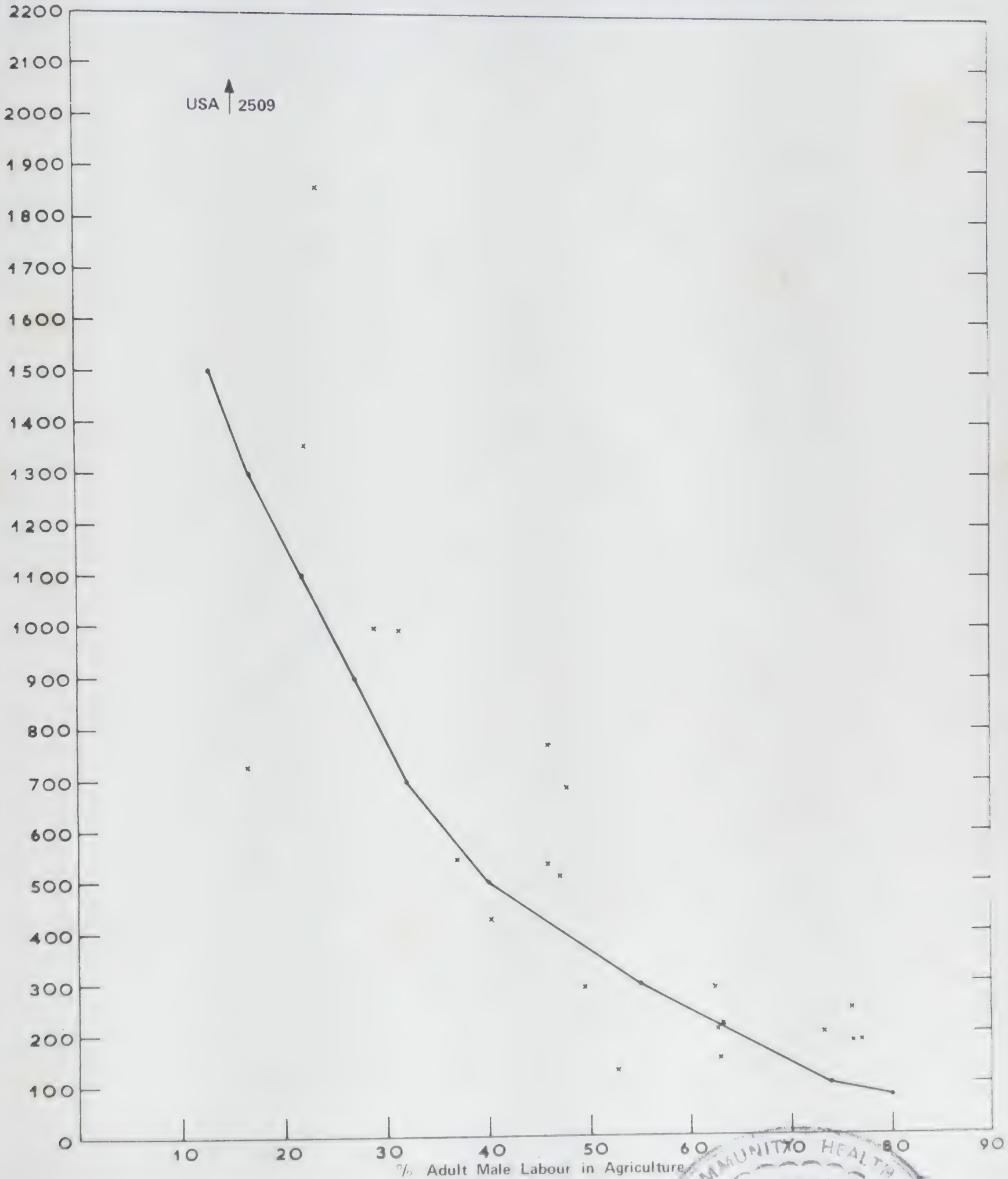


CHART 9

1960 BEST FITTING CURVE – 1950 Data (Original)

Per Capita Gross National Product and
Per Cent Adult Male Labour in Agriculture



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AND
DOCUMENTATION
UNIT

CHART 10

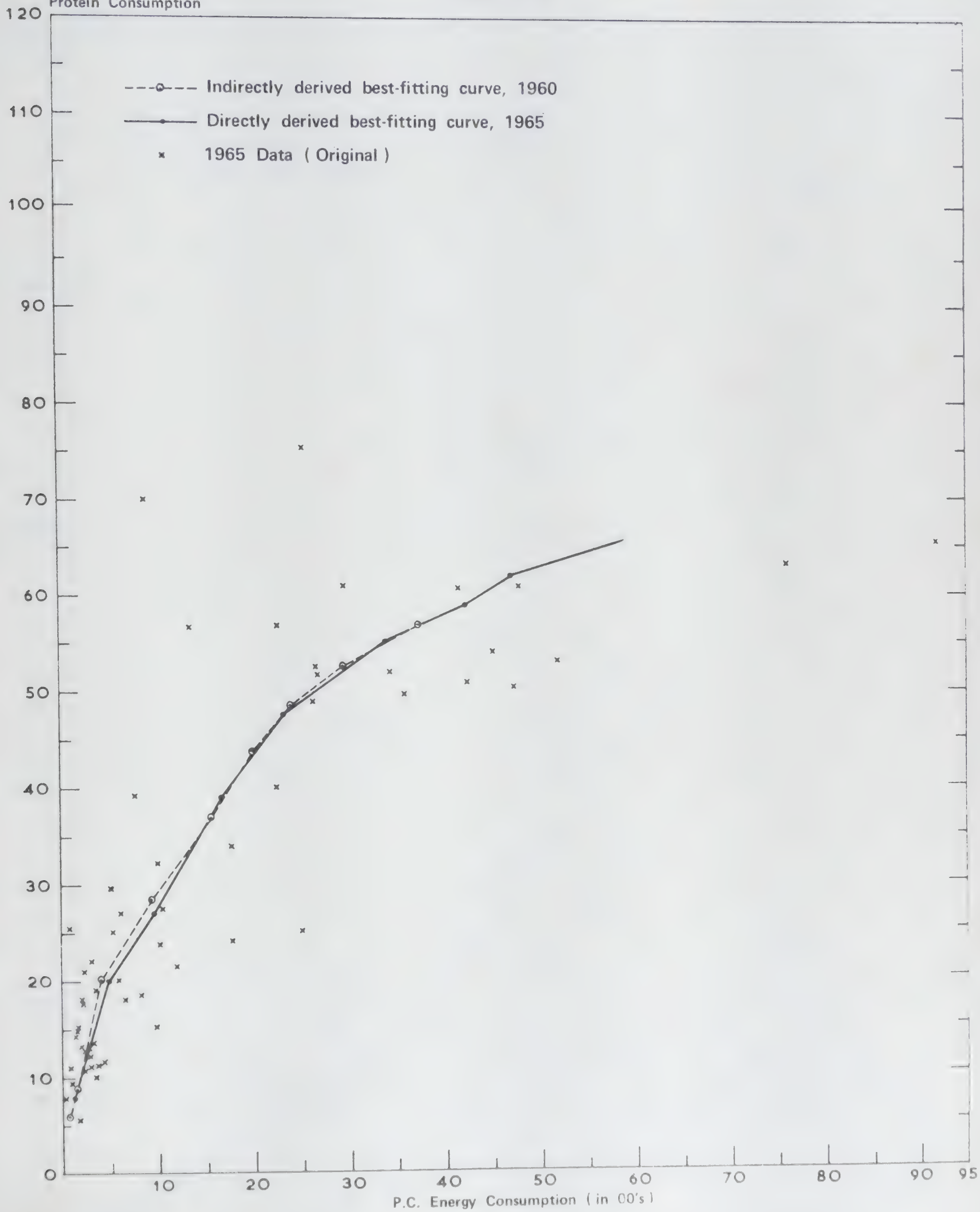
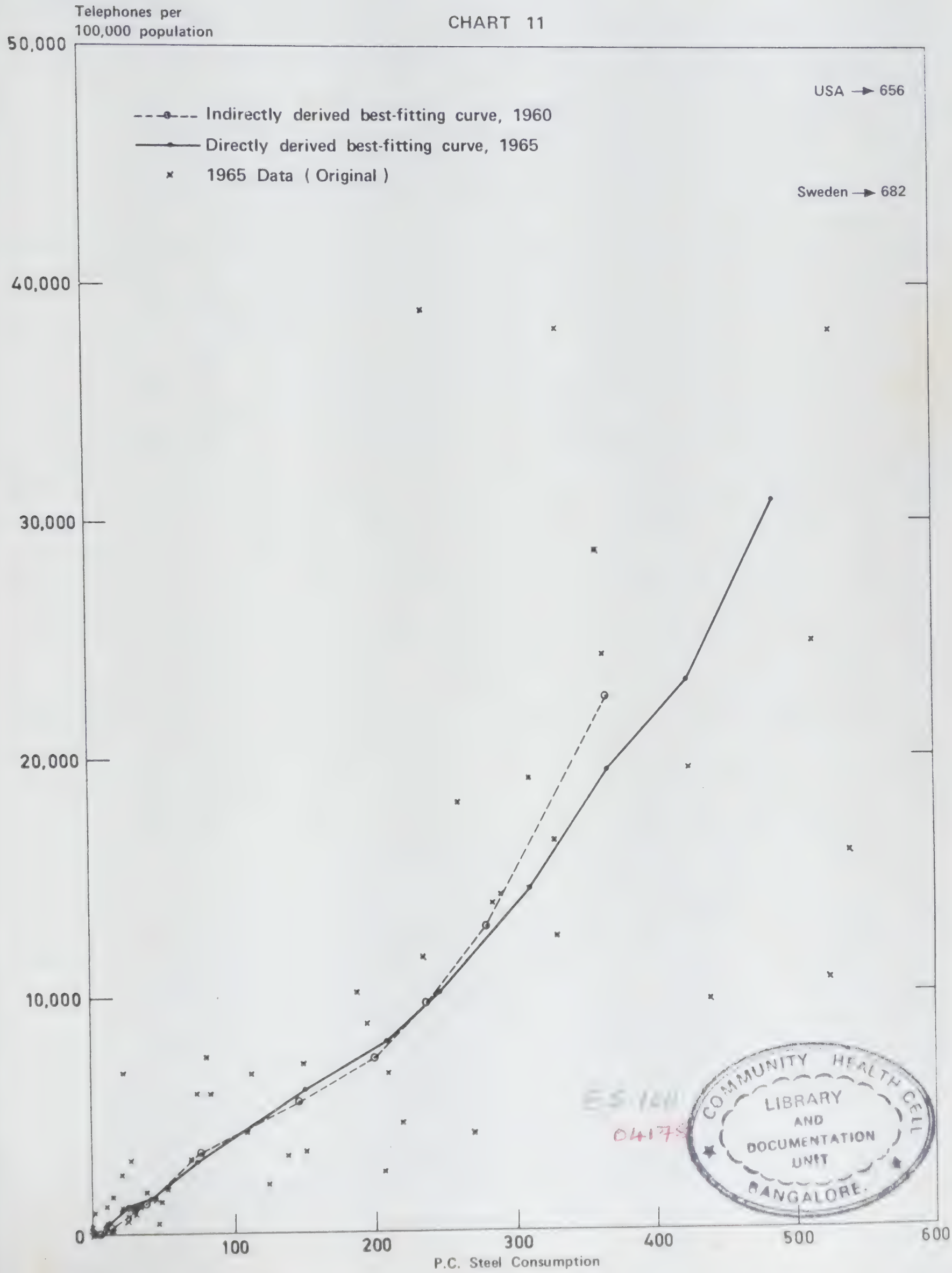

P.C. Animal Protein Consumption
Indirectly derived best-fitting curve, 1960
Directly derived best-fitting curve, 1965
1965 Data (Original)
120
110
100
90
80
70
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
90
95
P.C. Energy Consumption (in 00's)

CHART 11



COMMUNITY HEALTH CELL
LIBRARY
AND
DOCUMENTATION
UNIT
BANGALORE.

CHART 12

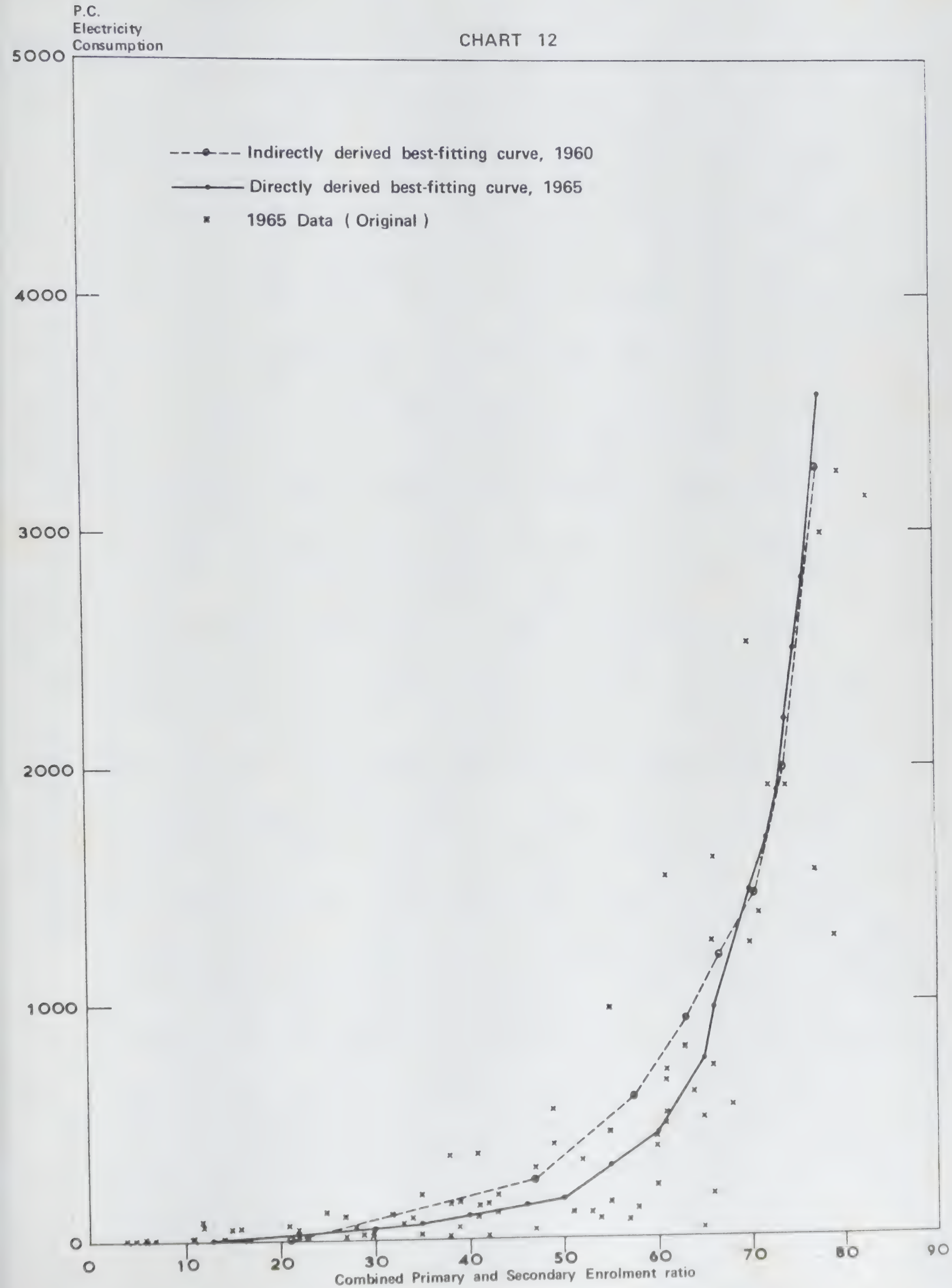

P.C.
Electricity
Consumption
5000
4000
3000
2000
1000
0
Indirectly derived best-fitting curve, 1960
Directly derived best-fitting curve, 1965
1965 Data (Original)
0
10
20
30
40
50
60
70
80
90
Combined Primary and Secondary Enrolment ratio

CHART 13

CORRESPONDENCE POINTS FOR CORE INDICATORS AND P.C. GNP, ORIGINAL DATA, 1960

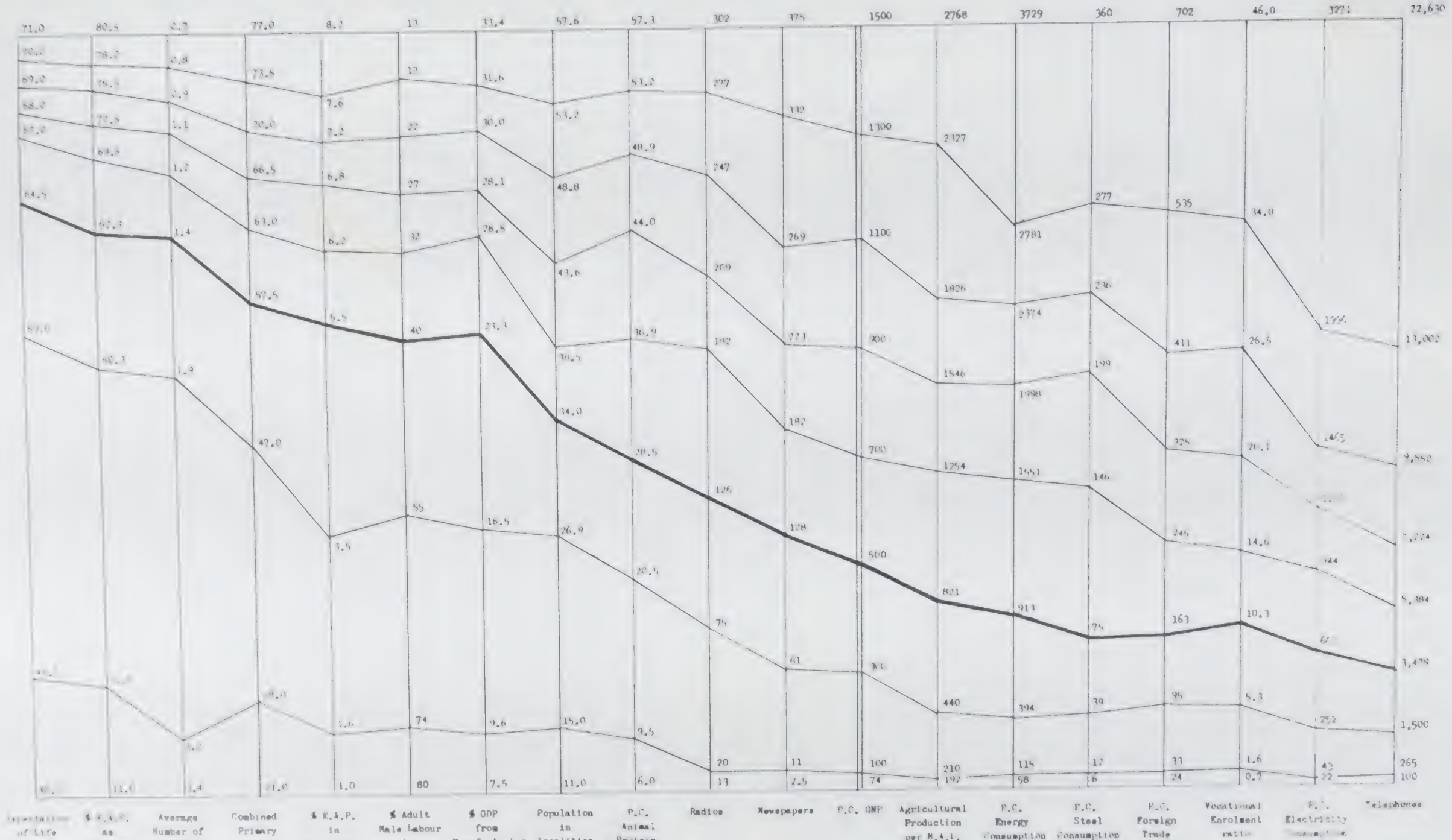
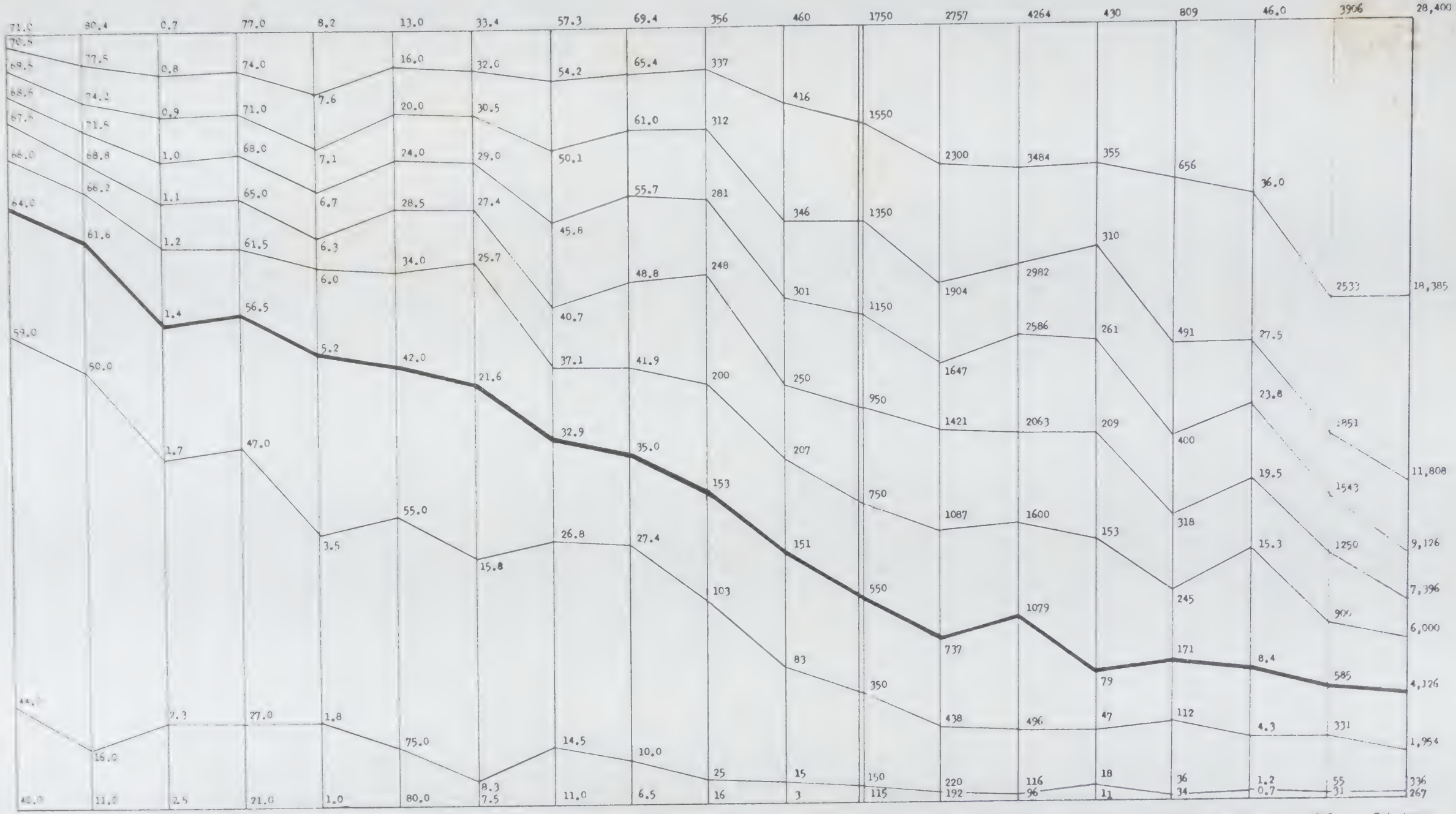

Expectation of Life at Birth
$ E.A.P. as Salaried and Wage-earners
Average Number of Persons per room
Combined Primary and Secondary Enrolment ratio
$ K.A.P. in Electricity, gas, water, sanitary services, transport, storage, communications
$ Adult Male Labour in Agriculture
$ GDP from Manufacturing
Population in localities of 20,000 plus
P.C. Animal Protein Consumption
Radios
Newspapers
P.C. GNP
Agricultural Production per M.A.L.
P.C. Energy Consumption
P.C. Steel Consumption
P.C. Foreign Trade
Vocational Enrolment ratio
P.C. Electricity Consumption
Telephones

CHART 14

CORRESPONDENCE POINTS FOR CORE INDICATORS AND P.C. GNP, ADJUSTED DATA, 1960


Expectation of Life at Birth
% E.A.P. as Salaried and Wage-earners
Average Number of Persons per room (½:1:1)
Combined Primary and Secondary Enrolment ratio
% E.A.P. in Electricity, gas, water, sanitary services, transport, storage, communications
% Adult Male Labour in Agriculture
% GDP from Manufacturing
Population in localities of 20,000 plus
P.C. Animal Protein Consumption (½:1:2/3)
Radios (1/3:1:1)
Newspapers (1/3:1:1)
P.C. GNP (½:1:2/3)
Agricultural Production per M.A.L.
P.C. Energy Consumption (½:1:2/3)
P.C. Steel Consumption (½:1:2/3)
P.C. Foreign Trade (½:1:2/3)
Vocational Enrolment ratio
P.C. Electricity Consumption (½:1:2/3)
Telephones (1/3:1:1)

. Figures in brackets give the adjustments for the age groups < 15 years, 15–64 years, and 65 and over, respectively.

CHART 15

BEST FITTING CURVE – 1960 Data (Original)

Per Capita Gross National Product and
Expectation of Life at Birth

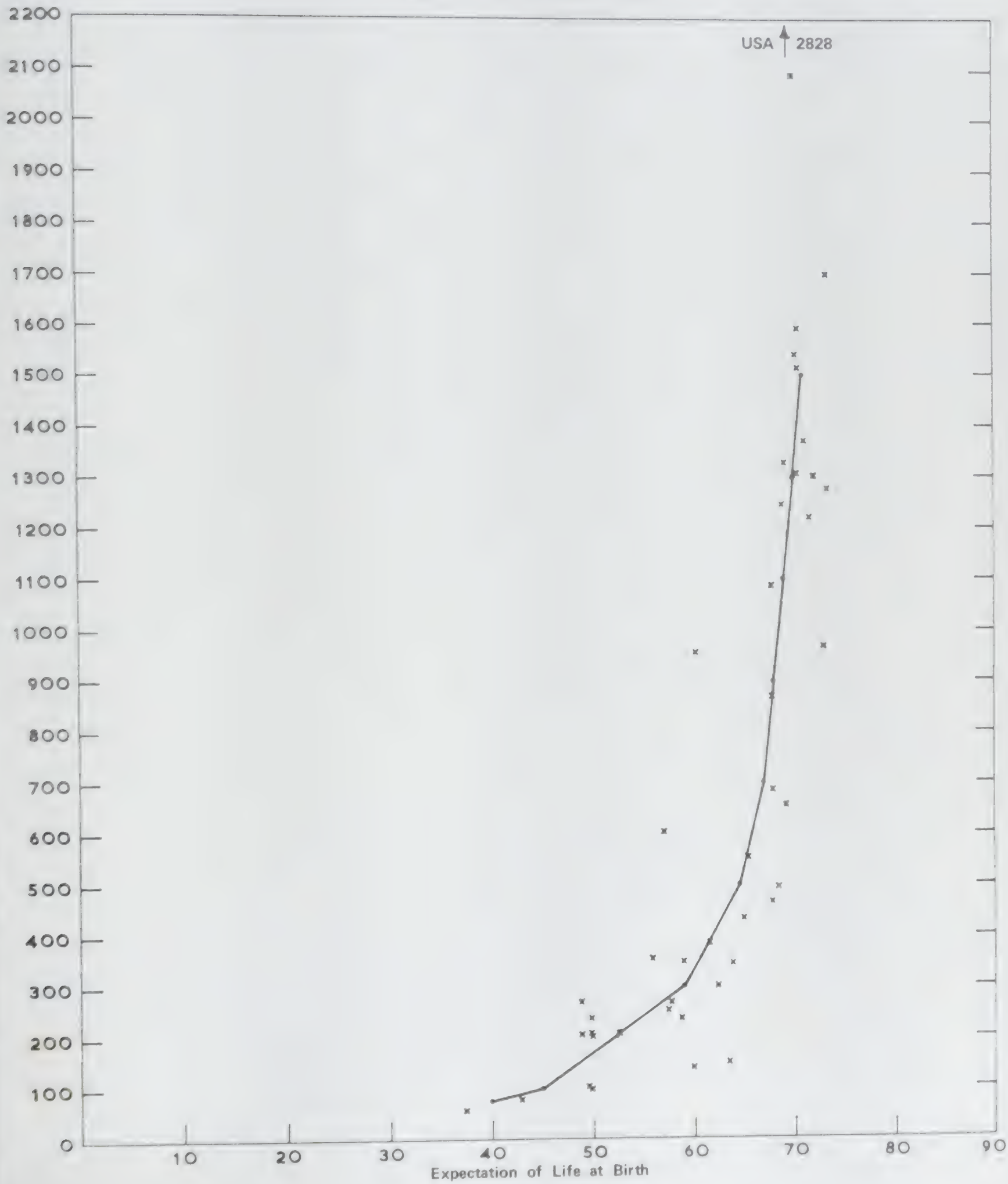


CHART 16

BEST FITTING CURVE – 1960 Data (Original)

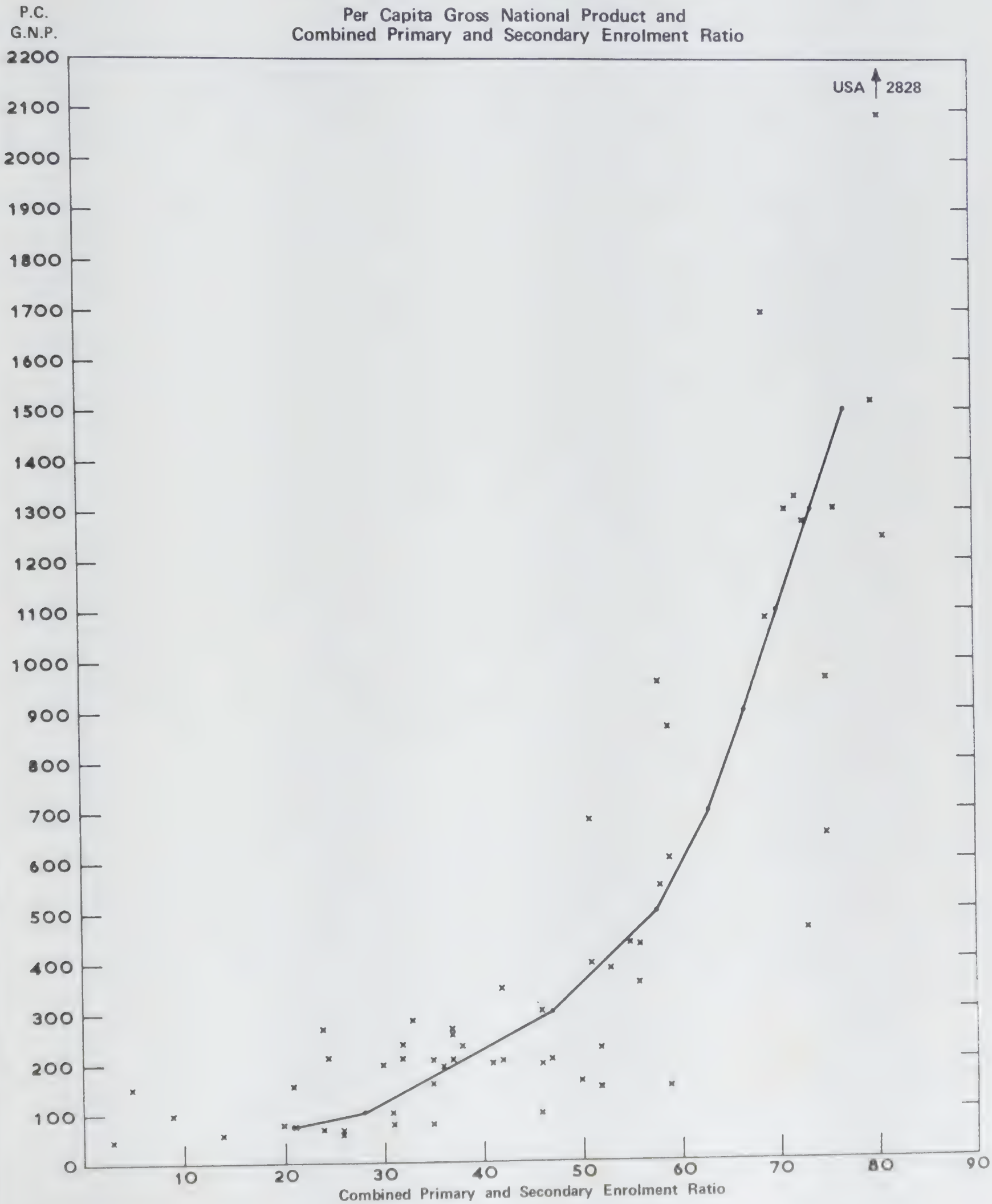


CHART 17

BEST FITTING CURVE – 1960 Data (Original)

Per Capita Gross National Product and
Average Number of Persons per Room

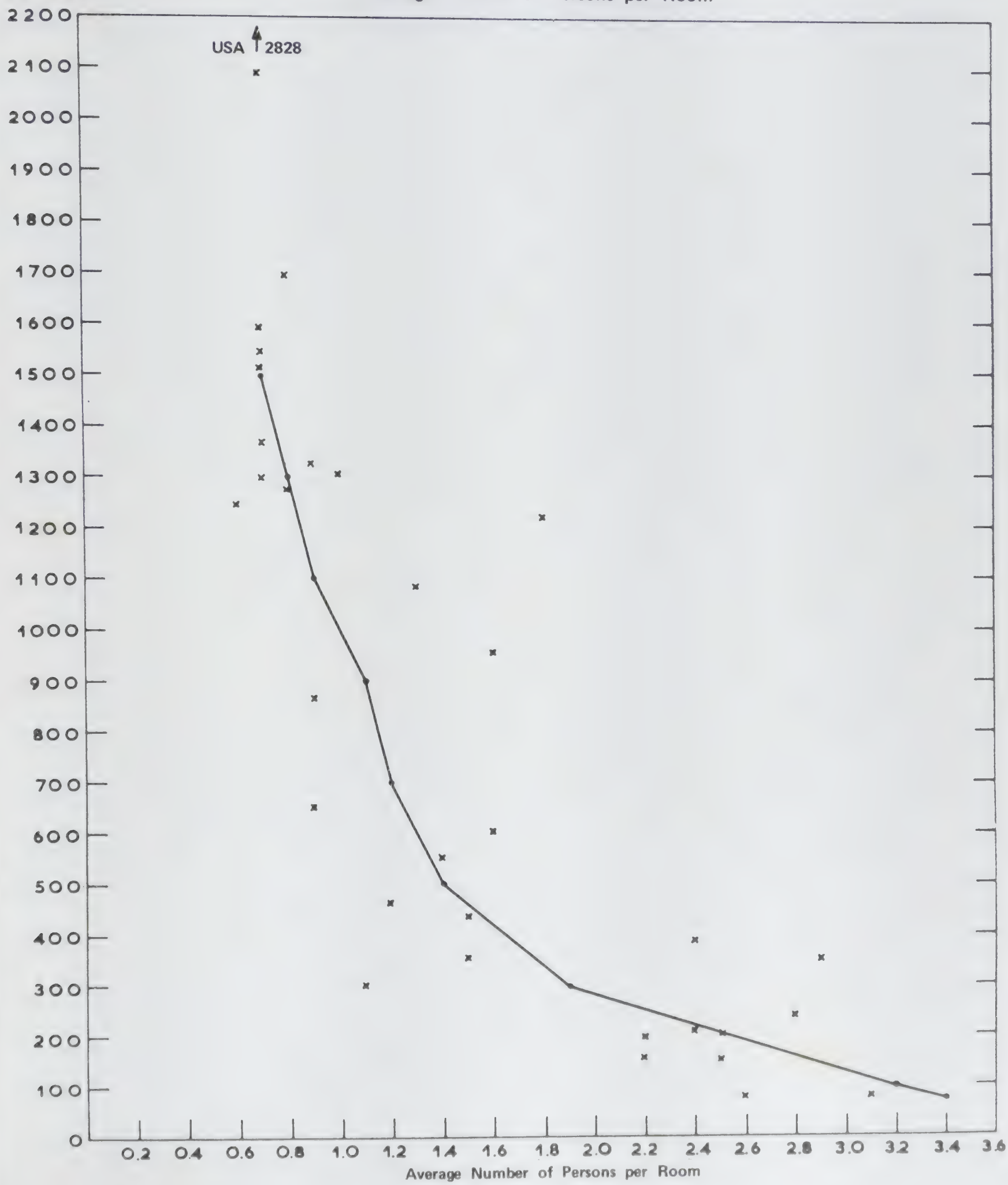


CHART 18

BEST FITTING CURVE – 1960 Data (Original)

Per Capita Gross National Product
and Salaried and Wage Earners as per Cent of
Total Economically Active Population

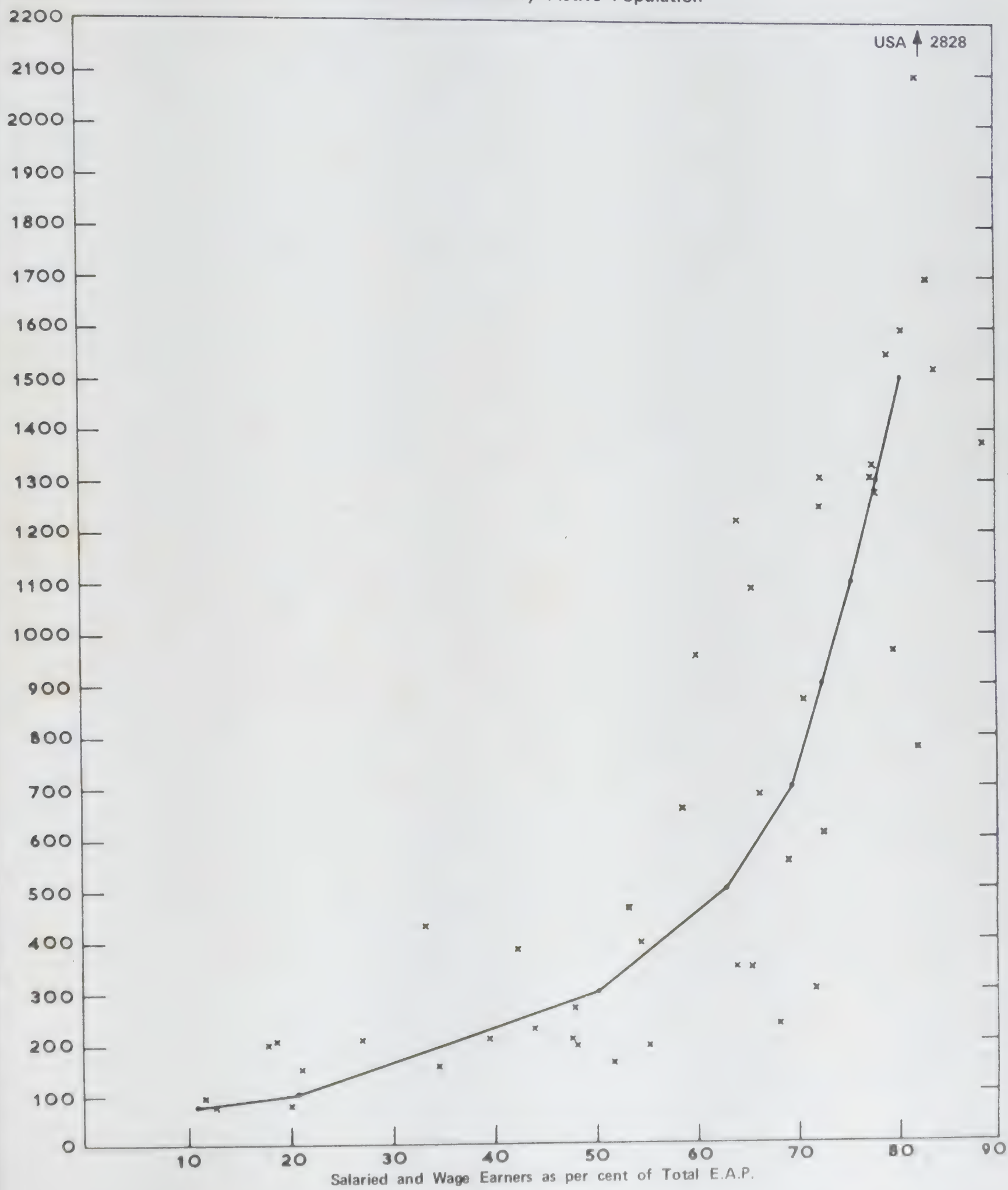


CHART 19

BEST FITTING CURVE – 1960 Data (Original)

Per Capita Gross National Product and
Crude Birth Rate

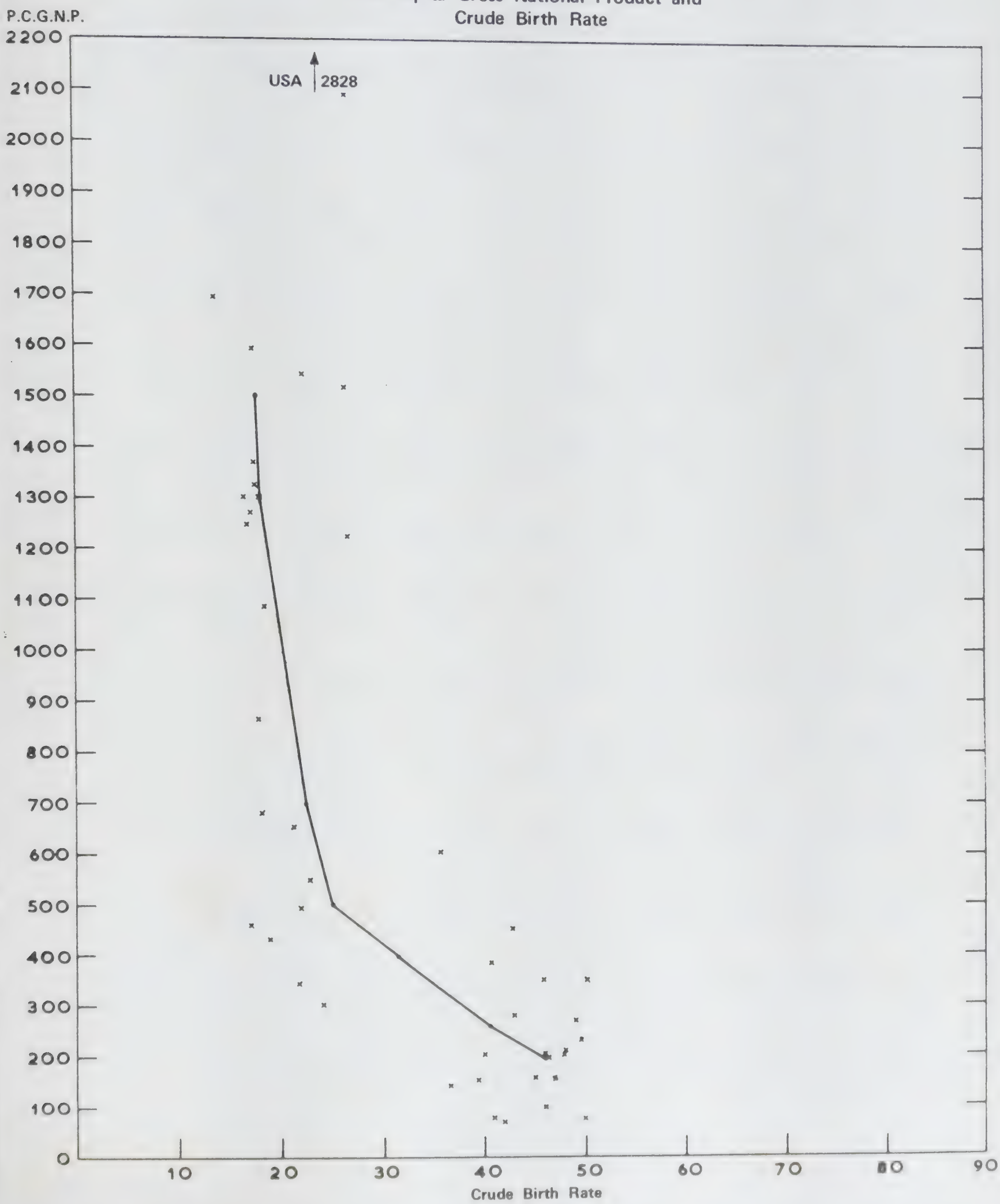


CHART 20

NETHERLANDS

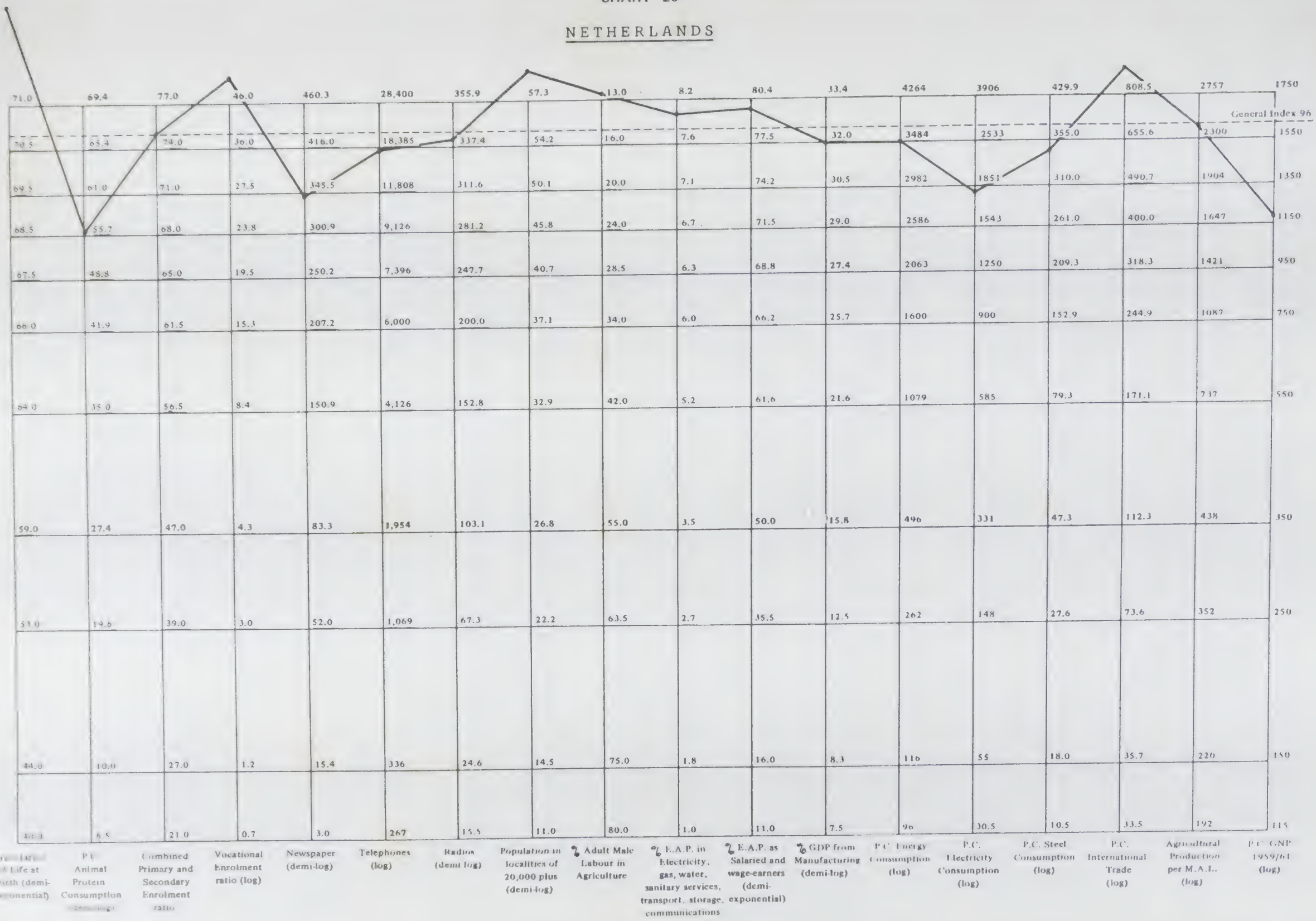
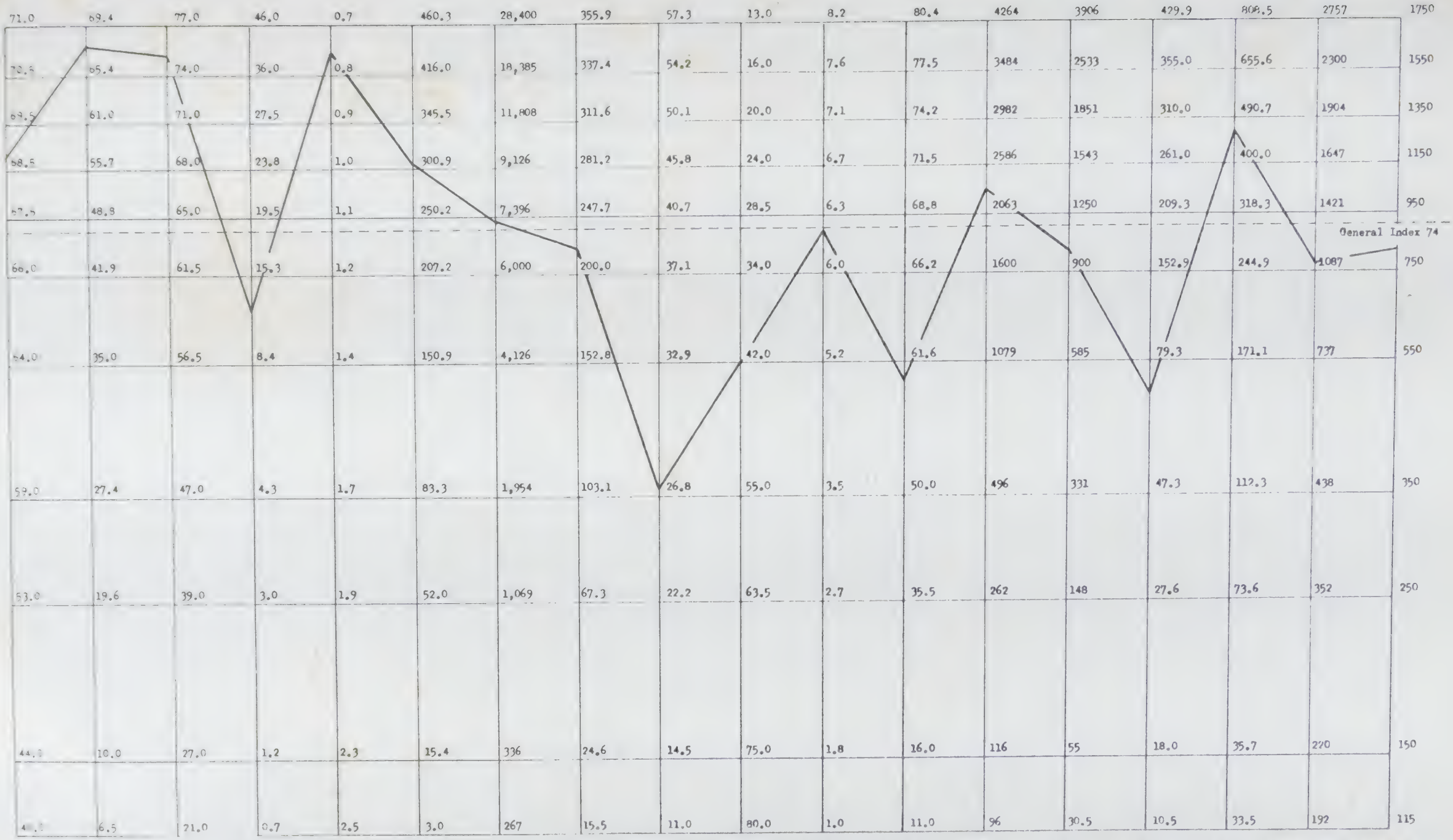


CHART 21

IRELAND



Expectation of Life at Birth (demi-exponential)	P.C. Animal Protein Consumption (demi-log)	Combined Primary and Secondary Enrolment ratio	Vocational Enrolment ratio (log)	Average Number of Persons per room	Newspapers (demi-log)	Telephones (log)	Radios (demi-log)	Population in localities of 20,000 plus (demi-log)	% Adult Male Labour in Agriculture	% E.A.P. in Electricity, gas, water, sanitary services, transport, storage, communications	% E.A.P. as Salaried and Wage-earners (demi-exponential)	P.C. Energy Consumption (log)	P.C. Electricity Consumption (log)	P.C. Steel Consumption (log)	P.C. Foreign Trade (log)	Agricultural Production per M.A.L. (log)	P.C. GNP (log)
71.0	69.4	77.0	46.0	0.7	460.3	28,400	355.9	57.3	13.0	8.2	80.4	4264	3906	429.9	809.5	2757	1750
70.5	65.4	74.0	36.0	0.8	416.0	18,385	337.4	54.2	16.0	7.6	77.5	3484	2533	355.0	655.6	2300	1550
69.5	61.0	71.0	27.5	0.9	345.5	11,808	311.6	50.1	20.0	7.1	74.2	2982	1851	310.0	490.7	1904	1350
68.5	55.7	68.0	23.8	1.0	300.9	9,126	281.2	45.8	24.0	6.7	71.5	2586	1543	261.0	400.0	1647	1150
67.5	48.8	65.0	19.5	1.1	250.2	7,396	247.7	40.7	28.5	6.3	68.8	2063	1250	209.3	318.3	1421	950
66.0	41.9	61.5	15.3	1.2	207.2	6,000	200.0	37.1	34.0	6.0	66.2	1600	900	152.9	244.9	1087	750
64.0	35.0	56.5	8.4	1.4	150.9	4,126	152.8	32.9	42.0	5.2	61.6	1079	585	79.3	171.1	737	550
59.0	27.4	47.0	4.3	1.7	83.3	1,954	103.1	26.8	55.0	3.5	50.0	496	331	47.3	112.3	438	350
53.0	19.6	39.0	3.0	1.9	52.0	1,069	67.3	22.2	63.5	2.7	35.5	262	148	27.6	73.6	352	250
44.3	10.0	27.0	1.2	2.3	15.4	336	24.6	14.5	75.0	1.8	16.0	116	55	18.0	35.7	220	150
40.0	6.5	21.0	0.7	2.5	3.0	267	15.5	11.0	80.0	1.0	11.0	96	30.5	10.5	33.5	192	115

CHART 22

VENEZUELA

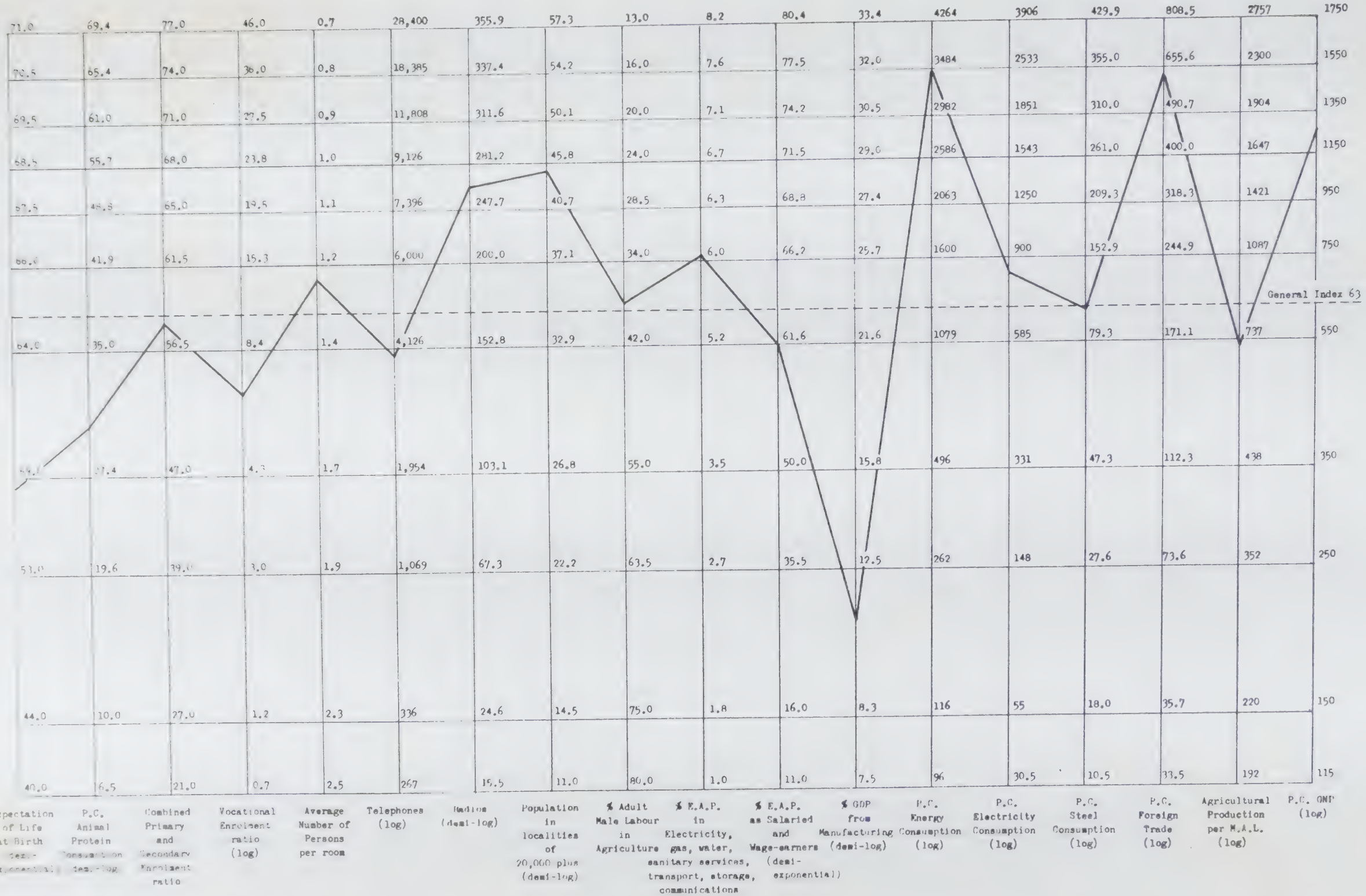


CHART 23

PHILIPPINES

Expectation of Life at Birth (demi-exponential)	P.C. Animal Protein Consumption (demi-log)	Combined Primary and Secondary Enrolment ratio	Newspapers (demi-log)	Telephones (log)	Radios (demi-log)	% Adult Male Labour in Agriculture	% E.A.P. in Electricity, gas, water, sanitary services, transport, storage, communications	% E.A.P. as Salaried and Wage-earners (demi-exponential)	% GDP from Manufacturing (demi-log)	P.C. Energy Consumption (log)	P.C. Electricity Consumption (log)	P.C. Steel Consumption (log)	P.C. Foreign Trade (log)	Agricultural Production per M.A.L. (log)	P.C. GNP (log)	
71.0	69.4	77.0	460.3	28,400	355.9	13.0	8.2	80.4	33.4	4264	3906	429.9	808.5	2757		1750
70.5	65.4	74.0	416.0	18,385	337.4	16.0	7.6	77.5	32.0	3484	2533	355.0	655.6	2300		1550
69.5	61.0	71.0	345.5	11,808	311.6	20.0	7.1	74.2	30.5	2982	1851	310.0	490.7	1904		1350
68.5	55.7	68.0	300.9	9,126	281.2	24.0	6.7	71.5	29.0	2586	1543	261.0	400.0	1647		1150
67.5	48.8	65.0	250.2	7,396	247.7	28.5	6.3	68.8	27.4	2063	1250	209.3	318.3	1421		950
66.0	41.9	61.5	207.2	6,000	200.0	34.0	6.0	66.2	25.7	1600	900	152.9	244.9	1087		750
64.0	35.0	56.5	150.9	4,126	152.8	42.0	5.2	61.6	21.6	1079	585	79.3	171.1	737		550
59.0	27.4	47.0	83.3	1,954	103.1	55.0	3.5	50.0	15.8	496	331	47.3	112.3	438		350
53.0	19.6	39.0	52.0	1,069	67.3	63.5	2.7	35.5	12.5	262	148	27.6	73.6	352		250
44.0	10.0	27.0	15.4	336	24.6	75.0	1.8	16.0	8.3	116	55	18.0	35.7	220		150
40.0	6.5	21.0	3.0	267	15.5	80.0	1.0	11.0	7.5	96	30.5	10.5	33.5	192		115

General Index 24

Chapter VI

SCALE TRANSFORMATIONS AND THE GENERAL INDEX OF DEVELOPMENT

The isolation of a core of development indicators and the calculation of correspondence points set the stage for attempting the construction of a unitary index of development - a general index to cover both economic and social factors. As noted in Chapter I, quantitative analysis through such an index is perhaps less useful in general than quantitative analysis of a country's development pattern in terms of a number of separate indicators which are interrelated through the correspondence system. But a general index, in the form of a weighted average of the different indicators, nevertheless can serve certain useful purposes.

In the construction of such an index, conversion into money is not possible as a means of combining the scores on the different indicators. Years of life expectation, amount of protein consumption per capita, level of urbanization, percentage of the (male) labour force outside agriculture, for example, cannot each be given a monetary value and then added up. Nor can any one of these indicators themselves - or any other single indicator - be used as a basis of conversion. It would not make sense, for example, to try to convert size of labour force outside agriculture into years of life expectation, on the assumption that a given percentage of the labour force outside agriculture has somehow an exchange value or worth of so many years of life expectation.

One way of trying to solve the problem of non-convertible values has been the method of "standard scores".[1/] This consists of calculating the mean value and the standard deviation of scores on each indicator; the mean value is then taken as the zero value for each indicator, the distance of any given raw score from the mean is measured in terms of standard deviations (plus or minus). Thus all scores become converted to positive or negative multiples of the standard deviation.[2/] As in the case of the mean, the standard deviation on any one indicator is taken as equivalent, for the purposes of common measurement, to the standard deviation on all other indicators. This method has the great merit of simplicity and of statistical sanctity.

1/ Another common method, the rank order method, whereby a country's rank on different indicators is averaged, may be useful for certain rough approximations but because of bunchings and spacings in distributions of developmental (cross-national) data, it is too imprecise and crude for present purposes.

2/ This approach is involved, for example, in the methodology known as the "Dresden Taxonomy". See Educational Planning, a survey of problems and prospects, UNESCO, ED/ICEP/3, Paris 6-14 August 1968; also Z. Hellwig, Towards a System of Qualitative Indicators of Components of Human Resource Development, Study III: "Procedures for Evaluating High Level Manpower Data and Typology of Countries by means of the Taxonomic Method". (Unpublished UNESCO Working Paper).

For a number of reasons, however, it was not considered suitable as a basis of setting up a general index of development in this study. In the first place, developmental data do not distribute themselves centrally about a mean, and the mean has limited significance in a sample of countries with widely different levels of development. In practice, the same countries found near the mean on one indicator will be found at a quite different level in relation to the mean of another indicator, even though in roughly the same rank position on both indicators.[1/] Furthermore, the mean and the standard deviation of a given indicator may be strongly influenced by the chance inclusion or exclusion of a single country that is abnormally high on that one indicator. These problems can be dealt with to some extent by mathematical transformations of the indicator data but a final major problem will remain: the fact that because of data insufficiency the arithmetic (or geometric) mean of the country scores on different indicators cannot be calculated for the same group of countries: the number of countries having data on all indicators, or on a fair number of them, is small and it would be necessary to reduce drastically the number of indicators or else make heavy reliance on estimates of uncertain reliability.

The Transformation of Scales

The method used in the present study has been to develop a transformation for each of the 18 core indicators to a common 0-100 scale on the basis of the correspondence points system. The problem of such scale transformation consists of two sub-problems: that of determining the extreme values or anchor points - in this case the zero and 100 points; and that of calibrating the intermediate values.

A different placing of the extreme points can alter the whole scale and the relative importance (implicit weighting) of the individual scores. If the zero point in regard to life expectation is placed at 0 years and the hundred point at say 71 years, then 59 years of life expectation would represent 83 percent on the converted 0-100 scale of life expectation; but if zero is placed at 40 years and the hundred point at 71 years, then 59 years of life expectation represents only 61 percent on the converted scale. A shifting of the zero point can thus give a quite different converted scale value to the original scores and it can have a considerable

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1/ Thus, the mean life expectation score of countries in our sample having both life expectation and school enrolment data is 62 years and the mean school enrolment is 41 per cent, but in fact countries having around 62 years life expectation tend to have around 71 per cent school enrolment, not 41 per cent.

implicit weighting or de-weighting effect on the indicator, according to whether the transformed values run high or low on the average. The same happens when the hundred point is fixed.

The possibility of determining zero and hundred points by a priori or conceptual methods was considered and rejected as arbitrary and unworkable. Determination of zero and hundred points in terms of lowest and highest actual country scores was also rejected because of the undue influence of eccentric - or quite possible inaccurate - scores;[1/] also because a country with the lowest or highest score on one indicator might not have any data at all on the next indicator.

The solution adopted was to set as zero points those values on the different indicators that constituted the lowest set of correspondence points, and the hundred points as the highest set of correspondence points, that it was feasible to obtain. In principle, best-fitting curves for the scatter diagrams of the raw scores of all pairs of indicators would consistently pass through these points. Thus, if 40 years of life expectation, 21 percent of children enrolled in primary and secondary schools together and 80 percent of adult male labour engaged in agriculture were zero points, then best-fitting curves on the relevant scatter diagrams would pass through: (a) 40 years of life expectation and 21 percent of children in school; (b) 40 years of life expectation and 80 percent of adult male labour in agriculture; (c) 21 percent of children in school and 80 percent of adult male labour in agriculture. This meant that the zero points would be, as far as possible, equally low on all scales from an objective or empirical point of view. In most cases the available data thinned out at the extremes and a certain amount of projection of the curves was sometimes necessary. This was done partly on the basis of the overall trend and partly on the basis of the known facts, both past and present, about the extreme values.

The method of constructing the correspondence points (use of moving averages, etc.) implies that, except where projections were made, the zero points were located at levels higher than the actual lowest scores in the sample and the hundred points at levels lower than the actual highest scores in the sample. This means in turn

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1/ Singapore, for example, has an exceptional amount of trade per capita - much more than any industrialized country. Hong Kong is quite exceptional in its amount of urbanization.

that when the 0-100 scale is set up and the raw scores of different countries are converted to that scale, some raw scores will be lower than the fixed zero values and others will be higher than the fixed hundred values. The problem of how to deal with such scores proved difficult. It was finally decided that raw scores below the zero point could not in principle be converted in regard to any indicator but that scores higher than the hundred point could be converted in the case of some indicators that had no apparent asymptotic limits.[1/]

The second problem of scale transformation, that of determining the intermediate points between 0 and 100 for each indicator, proved equally complex. It could not be assumed, for example, that if 96 was fixed as the zero point for energy consumption and 4264 the hundred point, then the fifty point on the transformed scale would be half-way between, namely 2180. As discussed above in relation to the correspondence chart, it was evident that different indicators had different patterns of change.[2/]

The basic problem was in effect to flatten the correspondence lines on Chart 14. A glance at this Chart will suggest that the indicators on the right hand side - which change slowly at first in relation to other indicators then more rapidly - would move into a more even position if transformed logarithmically. The opposite is true of the indicators at the extreme left. Thus the pattern of variation displayed by life expectation is one of much greater rate of change at lower levels and a slowing down at upper levels, a pattern that seems to call for an "exponential" transformation in which the raw scores are taken as logarithms and their anti-logs are found.[3/]

1/ The decision concerning scores below zero was taken not only because of the difficulties of downward projection but also because values below zero would be necessarily negative and this would create problems for (explicit) weighting. The weights in this analysis are fractions of one, and when applied to negative values they have the opposite effect from their effect on positive values. Thus countries having negative scores are unduly raised in the development scale and those with positive scores are relatively brought down. Finally, because of the transformations of indicators attempted later on, very small downward changes from zero in some indicators that were transformed logarithmically brought about very large negative scale values.

2/ This is consistent with common sense regarding growth patterns. It is assumed in economic practice that an indicator like per capita GNP has a geometric mode of growth and we speak of a ten percent increase equally when the growth is from $100 to $110, $500 to $550 or $1000 to $1100. Similar considerations apply to other per capita indicators of economic production. But no such assumption of geometric growth is justified in relation to life expectation or school enrolment. We cannot assume that if life expectation increases from 40 to 50 years in a given period then it should naturally move from 50 to 62.5 in the next period, and so on in the manner of compound interest.

3/ In actual practice, a "demi-exponential" transformation was used - an average of the exponential and the arithmetic, as in other cases a "demi-log" transformation, averaging the logarithmic and the arithmetic, was used.

In between, indicators were kept in their arithmetic form, or given a demi-log transformation. All transformations were carried out in such a way that one would move from the zero level score to the 100 level score for each indicator by a series of ten equivalent steps (thus, in the logarithmic conversions by a percentage increase which, repeated ten times beginning with the zero level score, would yield the hundred level score).

Table 10 presents the transformations that were carried out with respect to the individual indicators. Chart 24 shows the correspondence lines of Chart 14 after the scale transformations. It is clear that a considerable amount of flattening has been achieved. Complete flattening, however, cannot be hoped for by this method.

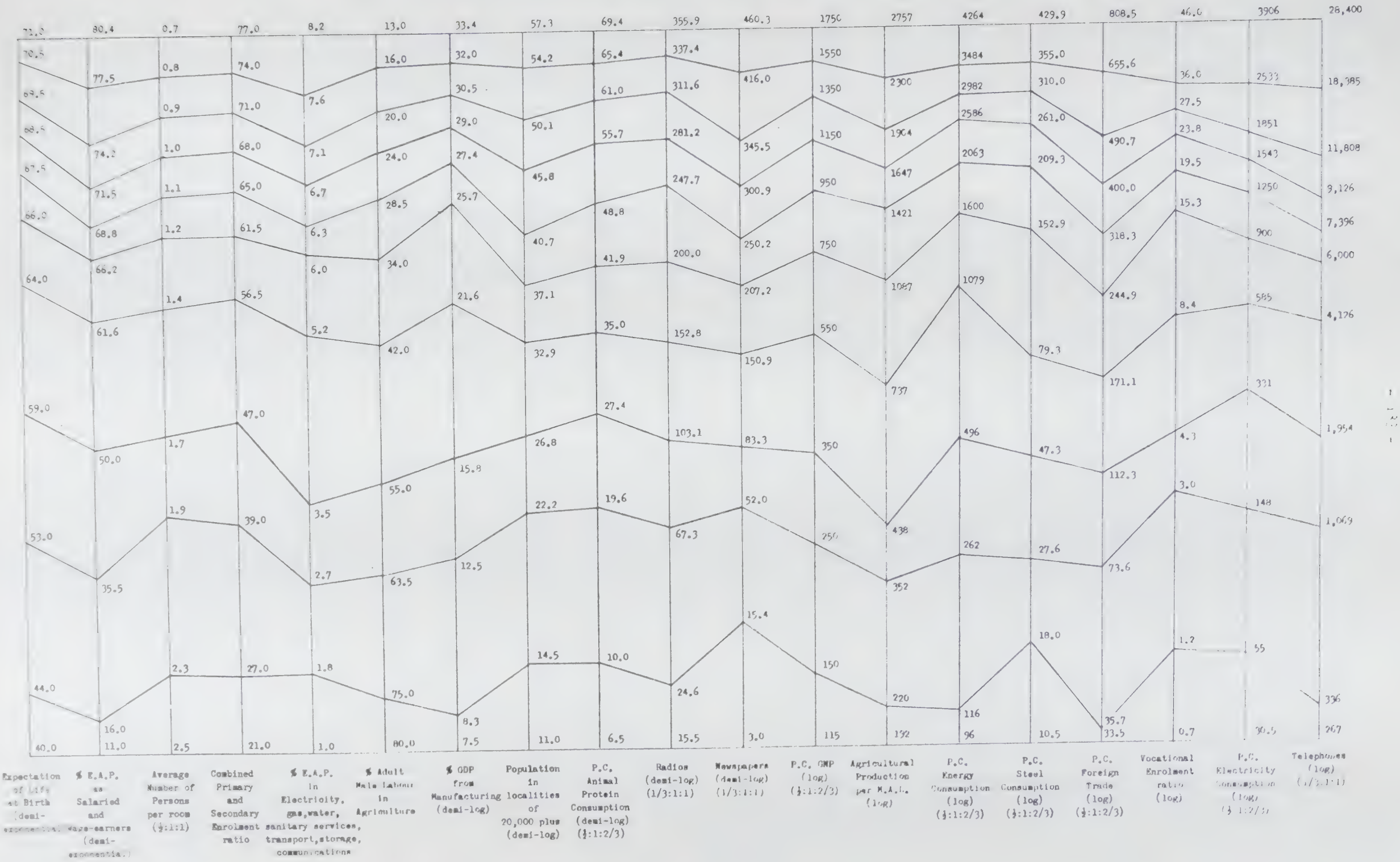
A further step can be taken for achieving absolute flatness. For each correspondence line (set of connected correspondence points), the values on the different transformed 0-100 scales can be read off and averaged. This average then becomes the final 0-100 score to which each indicator score on the given correspondence line is converted. Chart 25, entitled "Adjusted and transformed Correspondence points for 1960 data, with complete flattening", shows the results.

It is arguable whether this somewhat Procrustean method is justified for use in the construction of the general index. Calculations were carried out and it was found that whether or not the final step of averaging was carried out, the resulting index did not in fact differ except in the second decimal place. Index values used later in this chapter do not therefore employ the averaging method. However, Chart 25 incorporating the averaging has been used as a basis for presenting country profiles (in Chapter V) because of its obvious advantages for that purpose.

The effect of scale transformation on the measurement of development is as follows: if two industrialized countries differ by a given (absolute) amount on an indicator and the indicator is logarithmically transformed, this amount of difference has then less consequence for their general index score than when two developing countries differ by the same amount. Thus a difference of 100 kw per capita consumption of electricity between two industrialized countries, one having say 3,000 kw per capita (adjusted) and the other 3,100, is of much less consequence for the index than a difference of 100 between two developing countries, one having say 300 kw per capita and the other 400. The differences between developed and developing countries in general are reduced by the transformations.

CHART 24

CORRESPONDENCE POINTS FOR CORE INDICATORS AND P.C. GNP, ADJUSTED AND TRANSFORMED DATA, 1960


Expectation of Life at Birth (demi-exponential)
% E.A.P. as Salaried and Wage-earners (demi-exponential)
Average Number of Persons per room (½:1:1)
Combined Primary and Secondary Enrolment ratio
% E.A.P. in Electricity, gas, water, sanitary services, transport, storage, communications
% Adult Male Labour in Agriculture
% GDP from Manufacturing (demi-log)
Population in localities of 20,000 plus (demi-log)
P.C. Animal Protein Consumption (demi-log) (½:1:2/3)
Radios (demi-log) (1/3:1:1)
Newspapers (demi-log) (1/3:1:1)
P.C. GNP (log) (½:1:2/3)
Agricultural Production per M.A.L. (log)
P.C. Energy Consumption (log) (½:1:2/3)
P.C. Steel Consumption (log) (½:1:2/3)
P.C. Foreign Trade (log) (½:1:2/3)
Vocational Enrolment ratio (log)
P.C. Electricity Consumption (log) (½:1:2/3)
Telephones (log) (1/3:1:1)

. Figures in brackets give the adjustments for the age groups - 14 years, 15-64 years, and 65 years and over, respectively.

CHART 25

ADJUSTED AND TRANSFORMED CORRESPONDENCE POINTS FOR 1960 WITH COMPLETE FLATTENING

71.0	69.4	77.0	46.0	0.7	460.3	28,400	355.9	57.3	13.0	8.2	80.4	33.4	4264	3906	429.9	808.5	2757	1750
70.5	65.4	74.0	36.0	0.8	416.0	18,385	337.4	54.2	16.0	7.6	77.5	32.0	3484	2533	355.0	655.6	2300	1550
69.5	61.0	71.0	27.5	0.9	345.5	11,808	311.6	50.1	20.0	7.1	74.2	30.5	2982	1851	310.0	490.7	1904	1350
68.5	55.7	68.0	23.8	1.0	300.9	9,126	281.2	45.8	24.0	6.7	71.5	29.0	2586	1543	261.0	400.0	1647	1150
67.5	48.8	65.0	19.5	1.1	250.2	7,396	247.7	40.7	28.5	6.3	68.8	27.4	2063	1250	209.3	318.3	1421	950
66.0	42.9	61.5	15.3	1.2	207.2	6,000	200.0	37.1	34.0	6.0	66.2	25.7	1600	900	152.9	244.9	1087	750
64.0	35.0	56.5	8.4	1.4	150.9	4,126	152.8	32.9	42.0	5.2	61.6	21.6	1079	585	79.3	171.1	737	550
63.0	27.4	47.0	4.3	1.7	83.3	1,754	103.1	26.8	55.0	3.5	56.0	15.8	496	331	47.3	112.3	438	350
58.0	19.6	39.0	3.0	1.9	52.0	1,069	67.3	22.2	63.5	2.7	35.5	12.5	262	148	27.6	73.6	352	250
44.0	10.0	27.0	1.2	2.3	15.4	336	24.6	14.5	75.0	1.8	16.0	8.3	116	55	18.0	35.7	220	150
31.0	4.3	21.0	0.7	2.5	3.0	267	15.5	11.0	80.0	1.0	11.0	7.5	96	30.5	10.5	33.5	197	115

Expectation of life at birth (log-exponential) | P.C. Infant Mortality (demi-log) | Combined Primary and Secondary Enrolment ratio | Vocational Enrolment ratio (log) | Average Number of Persons per room | Newspapers (demi-log) | Telephones (log) | Radios (demi-log) | Population in localities of 20,000 plus (demi-log) | % Adult Male Labour in Agriculture | % E.A.P. in Electricity, gas, water, sanitary services, transport, storage, communications (demi-exponential) | % E.A.P. as Salaried and Wage-earners | % GDP from Manufacturing (demi-log) | P.C. Energy Consumption (log) | P.C. Electricity Consumption (log) | P.C. Steel Consumption (log) | P.C. Foreign Trade (log) | Agricultural Production per M.A.L. (log) | P.C. GNP (log)

In the case of other indicators, which are not so transformed, like educational enrolment, there are no such differential consequences depending on position of the countries on the scale. Finally, in two cases, life expectation and per cent of economically active population in the category of salaried personnel and wage-earners, which are transformed demi-exponentially, a given absolute difference - say, a difference of 5 years of life expectation between two countries - has somewhat more consequence for highly developed countries (where health improvements are slow and difficult) than for developing countries, and the differences between developed and developing countries are somewhat increased by the scale transformation.

Since most scale transformations in this study are of a logarithmic or demi-logarithmic nature, the net effect is that the differences between developed and developing countries in general appear smaller in the final index than would be the case if original figures were employed or if another system of scale transformation with more exponential conversion were used. The system used here was chosen on the basis of common sense assumptions that most of the percapita indicators in their progression resembled the per capita GNP where a given absolute increase is more important for poor than for rich countries.

Explicit weighting

The final problem in the construction of the general index is that of weighting - the determination of weights that are to be attached to scale values of each indicator when the indicators are combined. To be more precise, we are concerned here with explicit weighting, since, as indicated above, the process of scaling is to a very significant extent a matter of implicit weighting. The explicit weights reflect the degree of importance that each indicator is considered to have in the measurement of the whole. In the case of a general development index each indicator has to be weighted according to its importance in the total entity of development. But what is "importance" in this context? How is one to say on the basis of evidence available today that, for example, education is universally more important or less important for over-all development than agricultural productivity or manufacturing or trade, etc. - and by how much it is more important or less important? We do not have knowledge of preference patterns or of deterministic patterns that would permit such a conclusion. Furthermore, it must be recalled that we are dealing here with indicators, not with components of development, and a good indicator of a possibly weaker component may still be a better indicator of development as a whole than a poor indicator of a stronger component.

Reasons are given in Chapter I for the use of correlation as a basis of selecting indicators of development, and the same arguments apply to weighting. We consider that development is an interrelated phenomenon in which the different factors change and grow together over the long run; that the empirical evidence fully supports this assumption of interrelated growth; and that the degree of interrelatedness of an indicator with the whole - its average correlation with the other indicators - is the best available criterion of the weight that should be assigned to it in a general index. This does not at all mean that the indicator with the highest average correlation represents the factor that is most important for individual countries from the investment point of view. There are no universal priorities of that kind. All that is meant by the use of correlation as a basis of weighting is that the more heavily weighted indicator is the one which is most closely associated with and will best predict the others. Conversely, a general index constructed on such a weighting principle will best correlate with and best predict the scores on the individual indicators.

The decision to derive the system of weights from average of correlation coefficients, however, did not completely solve the problem. Earlier analysis (see Ch.III) had indicated that the same indicators could have different significance at different levels of development. Conceptually, it stands to reason that an indicator like literacy or calorie consumption, while important at lower levels, loses significance when a maximum or optimum is achieved and no further improvement can be reported. Empirically this is reflected in a loss of correlation at the higher levels. Other indicators (e.g., motor cars per 1000 population) appear to have little significance in low-income countries but more at higher levels. Such indicators, lacking significance for a large bloc of countries, are not in fact included among the 18 core indicators of this study. But the indicators that are included can nevertheless be assumed to have somewhat different significance at different levels, and to vary in their degree of correlation with general development according to the level of development.

In order to devise a system of weights that shifts with level of development, however, it is first necessary to be able to rank the countries in the sample by their level of development - and this calls for a system of weights. To break this circle, it was decided, as a first step, to set up a preliminary index of development using a uniform system of weights derived from the average intercorrelation coefficients of the core indicators (after conversion to the scale values).

In calculation of the preliminary index, the problem of missing data had to be faced: most countries had some data missing and some countries had information on only a few out of the 18 indicators. Tests were carried out of the effect of various methods of dealing with the problem of the weights of missing scores (by estimating missing scores, distributing weights of missing scores equally among those available, ignoring the missing scores). It was found that the differences between the methods were quite insignificant; the simplest thing was therefore to ignore the gaps, as far as the problem of weighting was concerned.

But a larger question remained: on how many indicators would a country need to have scores in order that its index could be reasonably computed? A decision was made on a minimum of ten out of the 18 indicators. There were 58 countries with data on at least 10 indicators - excluding also countries at the very lowest level, for reasons given above. The limitation of 10 indicators was put because it seemed unrealistic to calculate the index with half or more of the constitutents missing. If only a few of the 18 scores are missing, the statistical effect is small. If seven or eight scores are missing, the theoretically possible effects can be large, but the probability is that, for any given country, out of seven or eight missing scores, some will be scores high for that country's average and some low, so that the net effect will not be too great. But with more than eight missing scores it was felt that these considerations could not justify construction of the index.

The effects of missing scores (on the final index) are shown in Table 11. These data are based on a procedure of simulating ignorance of some of the scores actually known, and comparing the index so constructed with the index obtained with full use of scores. The results show that the recalculated index based on 10 or 11 scores taken at random[1/] differs from the index based on fuller data by only about one point for the individual countries examined in this test.

* * * * *

Once the 58 countries were chosen and their scores on the preliminary index determined, the countries were ranked and correlation matrices for 3 overlapping groups of these countries were processed: the bottom 29, the top 29 and a middle group of 29 between rank 16 and 45. The average correlation coefficient of each

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1/ In fact, the indicators eliminated were those for which annual data are not regularly available. The test was therefore concerned also with the viability of the index as an annual measure.

indicator in each of these three groups was calculated and was attached to the average value of the preliminary index in each group. This procedure gave for each indicator three points on the preliminary index scale. (Beyond the end-points, the values were considered equal to those of the end-points). By joining these a curve could be obtained from which to read off the weight to be given to an indicator at any given general level of development (as measured by the preliminary index).

In 10 out of 18 indicators the curves of weights across different levels are straight lines, 7 having a positive slope (i.e., the weighting is higher at the higher levels than at the lower levels) and 3 having negative slopes (i.e., weighting is lower at higher levels). In the case of the remaining indicators the curves are generally of second degree, 4 being concave from below and 4 convex from below.

This rather elaborate weighting system was expected to have significant consequences for the final index values. In fact, it did not. The scores on the final index with varying weighting are very little different for the 58 countries from the scores on the preliminary index with constant weighting. In the great majority of cases they are not actually very different (one point or less on the 1-100 scale) from the simple average of the transformed indicator scores without any explicit weighting at all.[1/] It is the method of scale transformation that is really important in the weighting of indicators, as is evident from the considerable discrepancies between the general scores of countries on a 0-100 scale without transformations and with transformations of the indicators.

Comparison of the General Index and the Per Capita GNP

Table 12 gives the scores of 58 countries on the general index and the per capita GNP - also, for comparison purposes, the per capita GNP in adjusted terms.

While there is a high correlation between the general index and the per capita GNP, the differences or exceptions in Table 12 are sufficiently striking to call for comment. There is evidence that the differences appear not only cross-nationally but also cross-temporally. That is, countries may increase their per capita GNP with relatively little increase of the general index, and vice versa;[2/] the rates of increase of the index and of the per capita GNP for 1950-60, when plotted on a scatter diagram, exhibit divergencies in a number of countries.

1/ This result appears to be due to the fact that even with varying correlations the weightings of the different indicators at any particular level do not differ greatly (not more than 25%), and with use of a fairly large number of indicators in combination, the weighting effects tend to cancel each other out.

2/ This is being investigated in a separate study.

In certain crucial cases in Table 12, such as Japan, Venezuela and Chile, the index is clearly a better measure of over-all development than the per capita GNP. In other cases one can be surprised at the differences without passing judgment.

The index is clearly superior to the per capita GNP in the sense that it is more closely correlated with the individual indicators, both economic and social, than is the per capita GNP. This is shown in Table 13.

It should be noted that the correlation between the general index and the per capita GNP is substantially reduced when countries are grouped into developed and developing (using as a dividing line for this purpose the index score of 50). The per capita GNP is more closely correlated with the index in developed than in developing countries. In the latter only about 45 per cent of the variation in the index is associated with ("explained by") the per capita GNP whereas about 75 per cent is so associated in the developed countries. Tables 14 and 15 bring out these points. They also show the related fact that the index has a considerably closer correlation with individual social and economic indicators in developing countries than does the per capita GNP, while the difference is not as great for developed countries. This suggests that the index is superior to the per capita GNP particularly in developing countries.

There are several possible explanations of the discrepancies between the index and the per capita GNP:

1. Technical deficiencies (along with temporal fluctuations) in the per capita GNP and the general index can explain some discrepancies. This is especially true where the GNP conversion rate to US dollars is open to considerable question.[1/] Since, however, as noted above, the per capita GNP and the general index do not necessarily change together even within individual countries (where conversion to dollars is not at issue), this is a limited explanation.

1/ For example, the Israeli figure of $1220 used in this study appears to be an overstatement based on one particular method of dollar conversion; the true figure is probably closer to $800.

2. The general index takes much more account of distribution and structure than does the per capita GNP. Countries in which much of the GNP tends to be associated with one particular activity (e.g., mineral extraction and sale abroad) will have a lower score on the general index than countries with more evenly distributed GNP. By redistribution of income or wealth a country may raise its index value but not necessarily its GNP. Venezuela's index appears to have risen faster than its per capita GNP in 1960-65 while in an earlier period the GNP rose much faster.

3. The inadequacy of the GNP in reflecting real values may be involved. As noted in Chapter I, a large and inefficient bureaucracy will be reckoned a contribution to the GNP in terms of its costs or the amount of income received by it, but that may have little relation to the real value of the services rendered. Increased expenditure on governmental bureaucracy (increased salaries or increased employees) appears on occasion to be a major element in recorded increase of GNP. The "real value" of goods and services sold on the market may also be poorly reflected in prices and hence in national income, quite apart from questions of inflation. Ineffective medical services and ineffective drugs can cost as much as effective ones but the level of health will be lower for the same level of expenditure and income. Inefficient telephone or electricity systems contribute more to national income per unit of service received than do efficient ones. So with other goods and services. The discrepancy between Japan's per capita GNP in 1960 and its general level of development may be due in part to relatively high efficiency of national income in this sense.1/

The general index can rise without significant concurrent rise of the per capita GNP if technological improvements are introduced into services and goods without price increase or volume increase; a rising index can continually stay ahead of a rising GNP.

4. Some of the countries with notable discrepancy between general index and per capita GNP were formerly the centres of empires. With dissolution of the empires, the highly developed core remained although the economy had to be readjusted.

1/ It should be made clear that this is something quite different from productivity. The latter refers to the market value of goods or services produced by an individual in a given period of time, whatever the quality, real value or effectiveness of these goods and services. We are concerned rather with the relation between price and real value - real value being understood to mean the actual benefits in real terms of the goods and services in question, whatever their price. The world market does not ensure a very close relation between price and real value for international comparison purposes.

Uses of the General Index

The general index is not a measure of the level of culture or civilization, or of human welfare or happiness, or of a "better life". It is essentially a measure of those characteristics that distinguish more developed from less developed countries and does not encompass the sum total of human values. It does not cover human freedoms, human relations, social tensions, maladjustments, crime and delinquency. It is seriously limited by lack of data. (It may become more useful with the new series of census enquiries undertaken around 1970).

Within these limitations, the general index does have certain uses:

1. It provides a means of estimating or predicting missing country values on development indicators. It is superior to the GNP for this purpose because of its higher correlation with the individual social and economic indicators (Table 13). The higher correlation is especially apparent when the regular per capita GNP is used. But even when the per capita GNP is itself mathematically transformed and correlated with transformed indicator values, the index continues to show higher correlations with the individual indicators, except for radio receivers and foreign trade. The index thus appears to reflect, and accordingly predict, the level of economic performance, as well as social and structural levels, somewhat better than does the per capita GNP. In spite of the close association a priori with the GNP of such factors as agricultural productivity, steel, energy and electricity consumption, empirically these factors are more closely correlated with the index.

The difference in predictive capacity between the index and the per capita GNP is indicated in regard to life expectation and electricity in Table 16. Randomly selected groups of countries with the relevant figures were dropped out, in a test involving simulated ignorance, and the index was re-built from the bottom up without taking account of these scores. The predictions from the index are superior to the predictions from the per capita GNP in both of these cases.[1/]

2. The index can be assumed to have fewer fluctuations than the GNP and therefore provides a more solid measure of actual growth. Income in a country may drop or rise suddenly from one year to the next, but the general index combining a number of factors does not show such a fluctuation and in that sense is much closer to the reality of a country's development.

3. The index would seem a more reasonable basis than the per capita GNP for separating developed from developing countries for purposes of analytical work.

A final use of the index is in connexion with typological analysis.

1/ In this test, the familiar regression method of predicting missing values from the per capita GNP is used also in predicting from the index, for life expectation. For electricity, the best-fitting curve method (which gives better predictions) is used.

Typological Analysis

The general index - or more precisely the system of scale transformation on which it is based - provides a means of carrying out certain kinds of "typological analysis",[1] in particular analysis of the influence on development of conditions like geographical size, population size, population density, climate, topographical features, culture area, which are "givens" in the sense that there is relatively little that can be done about a country's status regarding them. They are conditions to which other factors must adjust. They do not constitute objectives of development planning, except perhaps for population size or density - and even here the objective is generally not to decrease or increase population size or density but to decrease the rate of population growth. Very wide differences between countries in population size and density will remain whatever is done.

A country's general index score is, roughly, the average of its scores on the transformed indicators.[2] If a country had perfect "normality" in its indicator scores as derived from the transformed and completely flattened correspondence system (Chart 25), then these scores would all be equal, at whatever level of development. If a country is relatively high on one indicator compared to its average level, the amount of deviation will be measured by the difference between its index score and the transformed correspondence score of the indicator in question; the same amount of difference measured at different levels of development will in principle represent the same amount of deviation. In other words, the general level of development is controlled and it is possible to compare the amount of deviation, on a given indicator, of different countries at quite different levels of development. This makes it possible also to compare various types of country - say large countries vs. small countries - at different levels of development to see if countries of a given type have particular characteristics that persist throughout all levels.

1/ The expression "typological analysis" is sometimes used in connexion with any kind of classification - e.g., literate vs. illiterate populations, industrial vs. non-industrial nations. We are employing the expression here for classifications that refer to relatively permanent underlying conditions, which may affect change but are not part of it.

2/ As noted above, the index is not exactly the average but very close to it.

A separate study is being carried out on typological differences in socio-economic development by this method. For present purposes, certain preliminary results can be shown to indicate the method of analysis.

Fifty-seven countries for which index scores could be compiled were divided into three groups according to their geographical size,[1/] and the same procedure was repeated separately for population size and for population density. The deviations on each of the 18 indicators for the countries in each group were averaged, and the results are shown in Table 17.

One general result is worthy of note: there is frequently a lack of continuity in the apparent effect of typological conditions. Thus, medium-sized countries may be higher (or lower) on particular variables than both large and small countries.

The following observations can be made on Table 17:

1. The geographically large countries (but not the demographically large countries as a group) have consistently lower levels of health, as measured by life expectation, than would be expected from their general level of development. In fact, all eleven countries in the sample that have an area of more than 700,000 square kilometres and for which data are available show a negative deviation in life expectation scores for 1960. (Data are missing for Libya, South Africa, Iran and U.A.R. In Brazil the deviation is minor).

2. Sparsely populated countries (density of 1 to 16 persons per square kilometre) also appear to have relatively low health levels (Norway and Uruguay are the chief exceptions). Many of the sparsely populated countries are also geographically large - there is a considerable overlap in the two categories.

3. The picture is similar but not quite so marked for education: geographically large countries and sparsely populated countries, with certain exceptions, have lower levels of education than their general level of development would suggest. These deviations in health and education may reflect in part the greater difficulties and costs per head of geographically extended services and the greater differentiation and isolation of population groups in the large and the sparsely populated countries. The services may be concentrated in the cities or otherwise not available to certain groups.

1/ The three groups are only roughly equal in number since account was taken of natural breaks in the data in drawing the dividing lines between the large, medium and small categories. Hong-Kong was not included because of its unusual circumstances.

4. Paradoxically, the highest levels of urbanization are to be found in large countries and sparsely populated countries. Only three of the 17 sparsely populated countries in the sample (Finland, Norway and Canada) and three of the 15 large countries (Canada, U.S.A. and Turkey) have negative or slightly negative deviations in urbanization. One possible explanation is that a number of the large and/or sparsely populated countries are characterized by considerable unused or little used land - desert, high mountains, jungle, etc. (cf. Iran, U.A.R., Libya, Australia, Chile, Mexico, Venezuela) - and the population tends to congregate in the more habitable areas.

5. Geographically large countries, excepting Argentina and Chile, use more mechanical energy per capita than other countries - perhaps because of infrastructural requirements of transportation - but they do not derive as much of their GNP from manufacturing as do medium-sized countries, particularly medium-sized countries with large populations (e.g., Japan, German F.R., Italy, Philippines).

6. Countries small in population and also countries small in geographical area (there is an overlap of about 40%) are both characterized by relatively low levels of steel, energy and electricity, also a low level of manufacturing as a percentage of GNP. Of the 18 countries that are small in population or size or both, and have the relevant data, only two, Austria and Hungary, show higher than expected levels in steel usage. The majority of countries with small populations do not even record steel usage.1/

7. These same countries, small in size or in population or both, tend to show exceptionally high levels of foreign trade. (The only countries of small population with significantly negative figures on trade are Paraguay and Uruguay, and among countries of small size, South Korea, Portugal and China: Taiwan). The dependence on trade is especially striking in some of the small developing countries (e.g., Ceylon, Libya, Costa Rica, Jamaica, Panama), but the figures are fairly high also for small industrialized countries like Belgium, Denmark, Netherlands and Switzerland. Countries of large population are relatively low in (foreign) trade (Italy and Thailand are exceptions), but the same trend is not evident in countries of large

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1/ It should be recalled that in this study we have excluded countries with population less than 1,000,000. The countries small in population are those between 1 and 5 millions.

area - high levels of trade are found in large (but not heavily populated) countries like Libya, South Africa, Chile, Peru and Venezuela.

8. As might be expected, in densely populated countries at all levels of development there is less animal protein consumed per capita than in other countries at the same general levels. (Denmark, Poland and the Philippines are exceptions).

A more complete analysis is needed before the above findings can be properly judged. There is, for example, a major problem of overlapping categories. Thus, the finding that geographically large countries have relatively high levels of urbanization and low levels of health and education is affected by the fact that about half of the large countries in our sample having data on the relevant variables are Latin American countries, which appear as a group to have unusually high levels of urbanization but relatively low levels of health and education compared to other countries at similar levels of general development. If the Latin American countries are excluded, the tendencies noted above remain but to a less marked degree; the effect of the Latin American countries is largest in raising the level in urbanization of large countries as a group; there is some effect in lowering the average of the health levels of large countries but little effect as far as education is concerned.

At the same time, it is interesting to note that Latin American countries follow the general pattern as other countries, as regards urbanization - the smaller Latin American countries, like Costa Rica, Domenican Republic and El Salvador (also Jamaica) have <u>lower</u> levels of urbanization than would be expected for their general level of development. (Panama is an exception here).

These preliminary and partial results illustrating typological analysis raise questions, which are under study, regarding adjustments that should be made in the quantitative analysis and evaluation of development, to take account of typological differences. They also raise policy questions, concerning the extent to which countries can be said to differ not only in their development patterns but also in the kinds of pattern that are natural or normal for them, in view of their typological characteristics.

Table 10: LIST OF CORE INDICATORS
GIVING ADJUSTMENTS FOR AGE-STRUCTURE AND TRANSFORMATIONS, IF ANY

No.	Indicator	Adult-equivalents for age group (in years): <15	15-64	65+	Transformation
1.	Expectation of life at birth	-	-	-	Demi-exponential[1]
2.	Population in localities of 20,000 and over as per cent of total population	-	-	-	Demi-logarithmic[2]
3.	Consumption of animal protein, per capita, per day	1/2	1	2/3	Demi-logarithmic
4.	Combined primary and secondary enrolment as per cent of age group 5-19	-	-	-	-
5.	Vocational enrolment as per cent of age group 15-19	-	-	-	Logarithmic
6.	Average number of persons per room	1/2	1	1	-
7.	Newspaper ('daily general interest') circulation per 1000 population	1/3	1	1	Demi-logarithmic
8.	Telephones per 100,000 population	1/3	1	1	Logarithmic
9.	Radio receivers per 1000 population	1/3	1	1	Demi-logarithmic
10.	Per cent of economically active population in electricity, gas, water, sanitary services, transport, storage and communications (ISCO divisions 5, 7)	--	-	-	-
11.	Agricultural production per male agricultural worker (ISIC division 0), in 1960 U.S. dollars	-	-	-	Logarithmic
12.	Adult male labour in agriculture as per cent of total male labour (ISCO division 0)	-	-	-	-
13.	Electricity consumption, kwh. per capita	1/2	1	2/3	Logarithmic
14.	Steel consumption, kg. per capita	1/2	1	2/3	Logarithmic
15.	Energy consumption, kg. of coal equivalent per capita	1/2	1	2/3	Logarithmic
16.	GDP derived from manufacturing as per cent of total GDP (ISIC divisions 2-3)	-	-	-	Demi-logarithmic
17.	Foreign trade (sum of imports and exports) per capita, in 1960 U.S. dollars	1/2	1	2/3	Logarithmic
18.	Salaried and wage-earners as per cent of total economically active population	-	-	-	Demi-exponential
19.	P.C. GNP	1/2	1	2/3	Logarithmic

1/ The demi-exponential transformation values of an indicator are obtained by averaging the arithmetic and the exponential values (on 0-100 scales) of that indicator. The values are more or less the same as those obtained by using "square" transformation.

2/ The demi-logarithmic transformation values of an indicator are obtained by averaging the arithmetic and the logarithmic values (on 0-100 scales) of that indicator. The values are more or less the same as those obtained by using "square root" transformation.

Table 11

EFFECT OF MISSING SCORE ON FINAL INDEX

Country	Actual Index using all available data	Index after suppression of scores
DENMARK	95	95 *
AUSTRIA	86	87 *
VENEZUELA	63	64 **
PHILIPPINES	24	25 ***

* 7 out of 18 original values suppressed

** 7 out of 17 original values suppressed

*** 5 out of 15 original values suppressed

Table 12

DEVELOPMENT INDEX AND PER CAPITA GNP,
1960, FOR 58 COUNTRIES

Country	Development Index	P.C. GNP 1959/61
U.S.A.	111	2828
United Kingdom	104	1369
Canada	103	2092
New Zealand	103	1515
Sweden	103	1696
Australia	98	1542
Norway	98	1274
Belgium	96	1247
Netherlands	96	965
Switzerland	96	1591
Denmark	95	1300
Germany, Fed. Rep.	94	1327
France	88	1303
Austria	86	867
Finland	85	1085
Israel	81	1220
Hungary	75	-
Hong Kong	74	-
Ireland	74	653
Japan	74	463
Uruguay	74	494
Argentina	73	551
Poland	73	-
Italy	71	684
Venezuela	63	958
South Africa	62	453
Chile	61	604
Spain	58	344
Greece	52	432
Portugal	52	300
Yugoslavia	51	-

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Table 12 continued

Country	Development Index	P.C. GNP 1959/61
Costa Rica	50	352
Panama	48	385
China (Taiwan)	46	149
Colombia	46	253
Jamaica	45	396
Mexico	44	348
Brazil	38	267
Peru	37	198
U.A.R.	34	158
El Salvador	32	231
Jordan	32	196
Nicaragua	32	238
Syria	32	-
Ecuador	31	202
Dominican Republic	30	228
Libya	29	283
Paraguay	29	160
Turkey	27	202
Iran	26	210
Morocco	26	154
Korea, South	25	149
Philippines	24	206
Honduras	23	209
Guatemala	21	269
Ceylon	18	139
Ghana	16	195
Thailand	10	96

1/ Countries having the same value on the Development Index are arranged in alphabetical order.

Table 13: CORRELATION OF INDEX AND P.C. GNP WITH INDIVIDUAL CORE INDICATORS FOR 58 COUNTRIES, 1960.

Indicator 1/	Correlation of: General Index with: Adjusted and Transformed Indicator Values	Correlation of: General Index with: Original Indicator Values	Correlation of: Original per Capita GNP with: Adjusted and Transformed Indicator Values	Correlation of: Adjusted and Transformed Per Capita GNP with: Adjusted and Transformed Indicator Values
Expectation of life at birth	.92		.73	.84
% Population in localities of 20,000 and over	.82		.70	.77
Consumption of animal protein, per capita, per day	.91		.82	.87
Combined primary and secondary enrolment ratio	.88		.78	.82
Vocational enrolmen ratio	.88		.74	.71
Average number of persons per room	-.89		-.75	-.82
Newspaper circulation per 1,000 population	.93		.86	.89
Telephones per 100,000 population	.97		.93	.93
Radio receivers per 1,000 population	.84		.91	.86
% E.A.P. in electricity, gas, water, etc.	.90		.76	.86
Agricultural production per male agricultural worker	.96		.93	.94
% Adult male labour in agriculture	-.92		-.82	-.89
Electricity consumption, Kwh per capita	.96		.80	.92
Steel consumption, Kg per capita	.95		.87	.93
Energy consumption, Kg of coal equiv, per capita	.93		.93	.92
% GDP derived from manufacturing	.85		.65	.74
Foreign trade per capita, in 1960 U.S. dollars	.84		.75	.88
% Salaried and wage earners to total E.A.P.	.89		.75	.86
Crude birth rate 2/	-.81		-.64	-.75
P.C. GNP (original) 2/	.89		-	-
P.C. GNP (adjusted nd transformed) 2/	.95		-	-

1/ Abbreviated titles of indicators are used in this table. For complete titles see table 10.

2/ These indicators have been included in the list for reason of their interest although they were not used in the construction of the Development Index

Table 14: CORRELATION OF INDEX AND P.C. GNP WITH INDIVIDUAL CORE INDICATORS FOR 27 DEVELOPED COUNTRIES, 1960.

Indicator [1]	Correlation of: General Index with: Adjusted and Transformed Indicator Values	Correlation of: General Index with: Original Indicator Values	Correlation of: Original per Capita GNP with: Adjusted and Transformed Per Capita GNP with: Adjusted and Transformed Indicator Values
Expectation of life at birth	.55	.27	.19
% Population in localities of 20,000 and over	.72	.20	.20
Consumption of animal protein, per capita, per day	.66	.42	.42
Combined primary and secondary enrolment ratio	.46	.16	.07
Vocational enrolment ratio	.56	.17	-.04
Average number of persons per room	-.29	-.11	-.12
Newspaper circulation per 1,000 population	.80	.61	.51
Telephones per 100,000 population	.87	.73	.69
Radio receivers per 1,000 population	.71	.61	.61
% E.A.P. in electricity, gas, water, etc.	.72	.54	.57
Agricultural production per male agricultural worker	.53	.61	.67
% Adult male labour in agriculture	-.53	-.32	-.34
Electricity consumption, Kwh per capita	.88	.60	.66
Steel consumption, Kg per capita	.85	.79	.72
Energy consumption, Kg of coal equiv. per capita	.77	.57	.59
% GDP derived from manufacturing	.44	.10	.18
Foreign trade per capita, in 1960 U.S. dollars	.39	.72	.64
% Salaried and wage earners to total E.A.P.	.72	.53	.58
Crude birth rate	-.08	-.22	-.22
P.C. GNP (original) [2]	.67	-	-
P.C. GNP (adjusted and transformed) [2]	.67	-	-

1/ Abbreviated titles of indicators are used in this table. For complete titles see table 10.

2/ These indicators have been included in the list for reason of their interest although they were not used in the construction of the Development Index.

Table 15: CORRELATION OF INDEX AND P. C. GNP WITH INDIVIDUAL CORE INDICATORS FOR 31 DEVELOPED COUNTRIES, 1960

Indicator[1]	Correlation of: General Index with Adjusted and Transformed Indicator Values	Original per Capita GNP with Original Indicator Values	Adjusted and Transformed Per Capita GNP with Adjusted and Transformed Indicator Values
Expectation of life at birth	.82	.54	.62
% Population in localities of 20,000 and over	.54	.38	.37
Consumption of animal protein, per capita, per day	.78	.62	.65
Combined primary and secondary enrolment ratio	.80	.71	.76
Vocational enrolment ratio	.82	.52	.54
Average number of persons per room	-.79	-.58	-.57
Newspaper circulation per 1,000 population	.84	.63	.73
Telephones per 100,000 population	.92	.88	.81
Radio receivers per 1,000 population	.76	.86	.77
% E.A.P. in electricity, gas, water, etc.	.68	.50	.61
Agricultural production per male agricultural worker	.96	.87	.87
% Adult male labour in agriculture	-.77	-.69	-.74
Electricity consumption, Kwh per capita	.86	.69	.82
Steel consumption, Kg per capita	.85	.78	.82
Energy consumption, Kg of coal equiv. per capita	.78	.87	.85
% GDP derived from manufacturing	.57	.19	.21
Foreign trade per capita, in 1960 U.S. dollars	.75	.54	.77
% Salaried and wage earners to total E.A.P.	.81	.65	.68
Crude birth rate	-.29	-.18	-.19
P.C. GNP (original)[2]	.86	-	-
P.C. GNP (adjusted and transformed)[2]	.90	-	-

1/ Abbreviated titles of indicators are used in this table. For complete titles see table 10.

2/ These indicators have been included in the list for reason of their interest although they were not used in the construction of the Development Index.

Table 16:

PREDICTIONS OF SIMULATED MISSING SCORES IN ELECTRICITY AND EXPECTATION OF LIFE AT BIRTH FROM THE INDEX AND FROM THE PER CAPITA GNP

COUNTRY	PREDICTIONS* OF EXPECTATION OF LIFE AT BIRTH			
	ACTUAL VALUE	PREDICTION FROM INDEX	PREDICTION FROM P.C. GNP	PREDICTION FROM THE LOGARITHM OF P.C. GNP
Canada	70.3	72.6	124.8	75.2
U.S.A.	69.8	74.0	157.4	77.9
Denmark	72.1	70.2	67.9	70.3
Austria	68.0	68.2	64.0	67.6
Japan	67.8	64.8	60.5	61.2
Argentina	65.5	65.1	61.2	62.8
Brazil	57.7	56.9	58.7	56.6
Turkey	50.0	53.2	58.5	54.1
Philipines	52.5	51.1	58.2	53.2

* Regression is used for predictions

COUNTRY	PREDICTIONS** OF PER CAPITA ELECTRICITY		
	ACTUAL VALUE	PREDICTION FROM INDEX	PREDICTION FROM GNP
Australia	2901	3155	4479
W. Germany	2543	2531	2512
Japan	1440	1168	645
Portugal	447	494	363
Costa Rica	494	466	449
Colombia	346	403	271
Morocco	112	90	79
South Korea	91	83	69

** Best fitting curves are used for predictions

Table 17: AVERAGE DEVIATIONS OF TYPOLOGICAL GROUPING ON INDIVIDUAL INDICATORS

INDICATOR	AREA			POPULATION			DENSITY		
	Geographically large countries (over 700,000 sq.km.)	Medium sized countries (130,000 to 550,000 sq.km.)	Geographically small countries (less than 120,000 sq.km.)	Countries with large populations (20,000,000 or above	Countries with medium sized populations (5,000,000 to 19,000,000)	Countries with small populations (less than 5,000,000)	Densely populated countries (93 or more persons per sq.km.)	Countries of medium density (17 to 85 persons per sq.km)	Sparsely populated countries (16 or fewer persons per sq.km.)
Expectation of life at birth	-10.7	2.0	4.4	-0.9	+1.4	1.4	5.9	-0.1	-6.9
% Population in localities of 20000 and over	11.7	-3.7	-5.6	9.4	-0.4	-.3.1	-0.6	-3.3	7.0
Consumption of animal protein, per capita, per day	-0.5	0.8	-5.1	-4.5	-3.9	3.0	-8.6	-2.7	5.3
Combined primary and secondary enrolment ratio	-8.5	1.2	2.4	0.2	-4.0	0.5	3.2	-1.0	-4.8
Vocational enrolment ratio	-7.7	-3.4	4.1	-1.7	1.7	-5.2	7.9	-4 .6	-6.9
Average number of persons per room	-2.7	0.7	4.8	-5.6	7.4	-0.5	1.3	4.9	-2.2
Newspaper circulation per 1,000 population	-4.7	4.5	0.1	2.2	-1.5	2.5	1.1	1.2	0.8
Telephones per 100,000 population	2.3	1.7	2.4	2.6	0.7	2.9	0.8	3.0	2.4
Radio receivers per 1,000 population	9.8	-0.7	1.2	4.8	0.7	4.2	-1.5	5.5	4.8
% E.A.P. in electricity, gas, water, etc	-0.6	6.1	-2.6	-4.9	1.2	8.2	-3.3	-1.5	11.5
Agricultural production per male agricultural worker	-2.4	3.6	4.9	1.4	-0.4	5.5	4.4	2.7	-0.2
% Adult male labour in agriculture	1.4	-1.4	0.1	1.0	3.7	-4.9	1.2	0.8	-2.2
Electricity consumption, Kwh per capita	1.5	-0.9	-4.7	-0.7	1.5	-5.1	-2.1	-3.1	0.7
Steel consumption, Kg per capita	-1.3	-2.2	-6.9	2.6	-4.2	+11.4	-1.1	-2.1	-5.9
Energy consumption, Kg of coal equiv. per capita	8.0	-4.6	-4.3	2.6	1.4	-6.7	-2.0	-1.3	-0.2
% G.D.P. derived from manufacturing	-8.8	7.1	-8.2	7.9	-7.8	-7.5	-0.3	1.1	-7.4
Foreign trade per capita in 1960 U.S. dollars	-0.9	-3.6	8.3	-16.0	4.0	11.9	-0.4	0.1	3.9
% Salaried and wage earners to total E.A.P.	3.2	-3.2	1.1	-2.8	0.2	2.5	-1.1	-0.3	1.2

Chapter VII

IMPLICATION FOR THE DYNAMICS OF DEVELOPMENT

In this study we have tried to devise instruments for the quantitative analysis of development as a whole, covering both social and economic factors. It is a central thesis of the study that a unified approach to developmental analysis that makes use of cross-national data cannot rest on a mechanistic model, input-output model, functional dependency model or other conceptual scheme that views social factors in a one-way causal relation to economic factors. This is not because of the absence of causal influences but because of their very multiplicity and complexity. With comparative data we can describe the combinations of variables that exist but we cannot say why they exist - other than to say that social and economic factors seem to advance together in a system. If higher social levels appear together with higher economic levels, this can be due to the influence of the social on the economic, or of the economic on the social, or of third factors (e.g., political determination to develop) on both, or of various combinations of such influences; furthermore, the influences may be mediated through diverse kinds of causality ranging from the direct effects on economic productivity of better health and education, or the direct purchase of better health and education through more income, to the effects of violence and riots in forcing redistribution and readjustments between economic and social factors.

While our concern in this project is with descriptive analysis not with the dynamics of socio-economic development, the results should nonetheless be of some relevance to the dynamics, at least in setting up a framework for hypotheses. We conclude with a brief reference to some elementary implications for the dynamics of development.

Our analysis has suggested a certain coherence among the factors of development which appear to adjust themselves to each other as parts of an evolving system - not perfectly but perceptibly - so that standard profiles of factor growth can be drawn at the different levels of development, and deviations from the standard profiles can be measured. Typological adjustments can be introduced in more refined analysis.

From the perspective of this analysis, it is a natural assumption that a given factor input will not have the same effect on total development in the different growth environments of different countries. Response to an input will depend on the

nature of the existing system, not simply on the nature and amount of the input.[1] A crucial problem in the dynamics of development is therefore how to measure those characteristics of the system that affect its response to a given factor input - or define its need for a given factor input. One simple possibility is to measure the relative status, in the total complex, of the particular factor receiving the input. If, for example, a low-income country is exceptionally high in general primary and secondary education, compared with its other components, a given increment in such education may well not have the same effect on economic growth in that country as in a country with a comparatively low educational level. The former country may already have achieved as much primary and secondary education as can be effective for the time being for other components of development (which may now be holding back over-all growth and badly need investment); while the latter country may be seriously retarded in other components precisely because of lack of primary and secondary education.

The picture is complicated, however, by the fact that not only relative amounts of factor growth but also the effectiveness of the connecting links between the different factors will be involved. Thus the education level may be high and at the same time the education may be little effective because of poor quality, non-developmental orientation, traditionalist contents, etc.; or because the structure of economic production is such as to be little influenced by education (as in a plantation economy which rests on cheap unskilled labour).[2] Countries that have exceptionally high levels of education for their economic levels appear in a number of cases to have relatively ineffective education because the educational-economic

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1/ This principle is frequently acknowledged and frequently forgotten. The common tendency is to think in terms of inputs or combinations of inputs having much the same outputs everywhere, with perhaps a vague reference to "other things being equal." In fact, even the capital output ratio appears to vary greatly from country to country, and a study of economic growth rates of European countries in the 1950's showed little relation between amount of investment and growth of GDP (See United Nations, Some Factors in Economic Growth in Europe during the 1950's, Chapter II, Geneva, 1964, Sales No. 64.II.E.1).

2/ These questions are taken up in an UNRISD publication: "Levels of Living and Economic Growth: a comparative study of six countries 1950-1965", Report on an Institute study by Nancy Baster and Wolf Scott, United Nations Publication, Sales No.: E.69.IV.9.

linkage is weak. Over-all growth is slow - whereas in countries with more effective links (and relatively high education) over-all growth appears faster. A relatively high level of education can also mean that education is a "leading factor" in a country, sparking general growth, although elsewhere the prominence of education reflects a drain on resources. The comparative level of education is therefore only one element to take into account in estimating the response of the total developmental system to an increment in education.

To take a quite different example, an increase in urbanization in a country where the urbanization level is comparatively low, may be quite significant for general growth whereas it may have little significance or negative significance in a country that is already "over-urbanized" for its general level of development. At the same time, however, the role of urbanization may be "generative" in some countries, "parasitic" in others (including some already over-urbanized). Similar considerations apply to certain economic factors, a given growth of which in one country can be much more significant for total socio-economic development than in another country with different development pattern. We can refer also to the relative effectiveness or efficiency of the same economic levels or increments in different countries, as far as influence on other sectors is concerned, including the relative efficiency of the national income as a whole.1/

Thus, the impact of a given factor input on the totality of development will depend not only on the level and the pattern of existing development, but also on the effectiveness of the factor in question and the nature of the connecting links between factors. The tighter the links across sectors, the greater the over-all impact of a given input and the faster the over-all growth.

If these considerations are correct, then no valid universal formulas relating individual factors of development to other factors in a causal manner can be established for the dynamics of development, unless the pattern of development in individual countries and the nature of the connecting links can be taken into account. Correspondingly, no universalistic priorities or prescriptions, singling out one or

1/ By the relative efficiency of the national income is meant the extent to which a given level of national income is associated with relatively high levels of development as measured by real indicators of the kind used in this study.

another sector as the key to development for all countries, can be affirmed.[1] The developmental problems or needs of one country or one type of country (e.g., Latin American countries) may be quite different from those elsewhere.

Major emphasis must therefore be placed on the role of diagnosis in each country's over-all socio-economic development planning. For achieving integrated and balanced social and economic development, a major need is to build up the science - or art - of (cross-sectoral) developmental diagnosis. Use of an analytic approach of the type proposed in this report may, with refinements of data, provide one kind of assistance in such diagnosis. Diagnosis combines general and specific knowledge. There is no reason to swing from universalistic prescriptions to the opposite view that nothing is to be learned from other countries.

It must be emphasized again that the normal pattern of factor development at any given level, as determined through correspondence analysis, is not necessarily the ideal pattern or the most dynamic pattern.[2] Also, it is only one instrument in the attempt of a country to build up an idea of its optimum pattern, for the purpose of over-all development planning. We assume that a comprehensive socio-economic development plan should be guided by a conception of an optimum feasible future pattern - that a specified per capita GNP growth is not an adequate guide; nor would we consider that a general index could serve the purpose.

1/ By this is not meant that all components are equal in their effects, can equally function as "leading factors", should have the same allocation of resources, etc. The argument is rather that in an evolving system of interrelationships, priority should go to those sectors where maximum benefits for growth of the total system can be expected, and these will differ from country to country.

2/ On the other hand, there can be no assumption either that the normal pattern at a given level is a state of "static equilibrium", or that deviations from the normal pattern are necessarily deviations in the direction of "dynamic imbalance".